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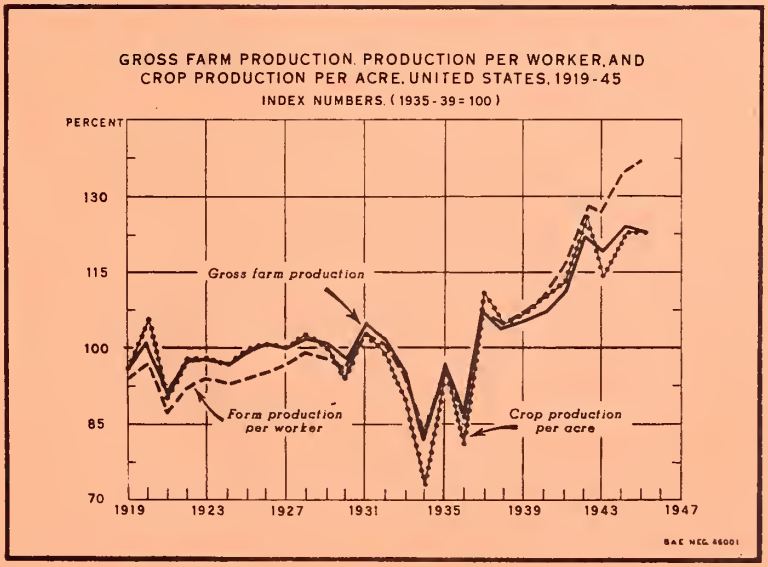
Changes IN FARMING IN WAR AND PEACE



by

Sherman E. Johnson

WASHINGTON, D. C.

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PREFACE

This report summarizes a study that was begun in the fall of 1944 with the objectives of analyzing the changes in farming during the interwar and war years, appraising the forces back of the large increases in production, and evaluating some of their peacetime implications.

This summary and the separate reports on which it is based were prepared in the belief that a first requisite for intelligent action on our peacetime production problems is an understanding of the nature and strength of the forces which have shaped the course of agricultural production in recent years. These forces will continue to influence production in the years to come. But new forces will be injected. Some of these are already on the horizon--the mechanical cotton picker is an example. Others cannot be foreseen. But constant change must be expected; and agriculture must adapt itself to changes that are inevitable and, for the most part, desirable.

Revolutionary changes in farm production have taken place in the last quarter-century. Policies developed for the present and for the prospective production situation need to look forward in the light of recent developments and of those which can now be foreseen. They cannot be fashioned from the pattern that prevailed before the age of mechanical power and before other fundamental changes had taken place.

The background data used for this analysis are largely the statistics contained in the crop and livestock reports and other production releases of the Bureau of Agricultural Economics.

Many workers have participated in this study. Several reports were released that deal with changes in specific commodities, or with other segments of the war and interwar changes in farming. Basic to this summary report is the special study reported in Farm Production in War and Peace, by Glen T. Barton and Martin R. Cooper, issued by this Bureau. Others who have worked on specific parts of the study are: Neil W. Johnson, C. W. Crickman, Carl P. Heisig, E. L. Langsford, Donald B. Ibach, Olav Anderson, R. D. Jennings, S. W. Mendum, E. G. Strand, Weber Peterson, W. D. Goodsell, R. W. Jones, J. R. Ferrell, E. R. Ahrendes, L. Jay Atkinson, R. W. Hecht, A. P. Brodell, and Della E. Merrick who assembled and helped to prepare materials for the entire project. Paul L. Koenig, R. K. Smith, and the late J. B. Shepard were especially helpful on appraisals of background data.

CHANGES IN FARMING IN WAR AND PEACE

By

Sherman E. Johnson, Agricultural Economist

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SIGNIFICANCE OF WARTIME CHANGES

Farmers achieved a marvelous production record in the war years. The increase in total production from 1939 to 1944 was twice as large as during the entire 20-year period from 1919 to 1939. This wartime record was accomplished without significant expansion in the acreage of cropland, and despite insufficient supplies of labor, machinery, and other materials.

Gross farm production (including farm-produced power) for the 3 full war years 1942-44 averaged 122 percent of the prewar years 1935-39. In 1944, gross production was 124 percent of prewar, and this level was approximated in 1945. If production is measured in terms of farm output for human use, which excludes farm-produced power, the wartime increase is even higher. Farm output averaged 127 percent of prewar for the years 1942-44 (fig. 1, page 64). 1/

This tremendous increase in output constitutes an unprecedented break from the immediate past. Usually changes in farming develop very slowly. They are often unnoticed until the record over a period of years is examined. Even such major innovations as the tractor and machines adapted for mechanical power were introduced so gradually that they escaped special attention until their cumulative effects became unusually pronounced.

Sometimes extremely favorable or unfavorable weather causes large year-to-year changes in production. For example, 1934 was a year of catastrophic drought, and farm production was much lower than in the preceding years. In 1942, growing conditions were unusually favorable. In fact, consistently good weather was experienced in the 3 war years 1942-44 as compared with the average of the years 1935-39. But those prewar years reflect weather conditions that were about 5 to 10 percent less favorable to farm production than is the expectancy over a period of years. The factors of weather affecting farm production in 1942-44 probably were only 10 to 15 percent more favorable than longer-time expectancy.

Considering the average of the years 1942-44, it appears that no more than one-fourth of the total increase in production can be accounted for by weather conditions that were more favorable than in the prewar years 1935-39. This means that with normal weather the gross farm production in 1942-44 would have averaged about 117 percent of 1935-39, and farm output would have averaged at least 120 percent.

Obviously then, only a rather small part of the wartime increase in production can be explained by the extremely favorable weather. And it follows that a return to average weather conditions alone would not bring a return to prewar production levels. Extremely unfavorable weather would reduce output temporarily, but agriculture has experienced a production revolution during the war years. And a large part of the change is irreversible. It will persist under peacetime conditions. To understand what has taken place it is necessary to analyze what happened in the war years, to compare this experience with the record in World War I, and to trace the foundation for wartime increases that was laid in the interwar years.

1/ For a detailed explanation of how these index measures of production are constructed see "Farm Production in War and Peace," by Glenn T. Barton and Martin R. Cooper, U. S. Department of Agriculture, Bureau of Agricultural Economics. (F.M. No. 53, mimeographed).

The War Years

War and wartime needs for food, and the doubling of the prices received by farmers for their products, furnished the driving force for increased production, but a combination of favorable physical circumstances made the large-scale increase possible. Potential production capacity had been built up over a period of several years previous to the outbreak of World War II. This increased capacity had its origin in a number of factors, and each has contributed to the increased wartime output. By a fortunate conjuncture of circumstances progress in mechanization, an increased use of lime and fertilizer, cover crops, and other conservation practices, use of improved varieties, a better balanced feeding of livestock, and more effective control of insects and disease had all gathered momentum over the several years preceding World War II. Their current effects were obscured by the drought and depression of the 1930's, but developments had reached a stage where these improvements could be effectively combined and used in an all-out production effort. The result was an unprecedented production increase.

The joint effects of these technological improvements on the volume of production may be illustrated by comparing them with the effects of the flow of water in its several tributaries on the water level of a large river. If water rises to flood stage in one of the tributaries this will of course increase the water level in the main stream, but if the tributary is small the effect may be scarcely noticeable when its flood reaches the main channel. Similarly, the effect of single improvements in farm production, that are important by themselves, are scarcely perceptible in their effect on total production. But if all the tributaries of a large river reach flood stage at the same time, the water in the main channel also will rise to flood stage, and the change in the water level does not escape notice. In a sense this is the effect that adoption of the accumulation of technological improvements had on farm production in the years of World War II.

But one might make the comparison somewhat differently, and more correctly, by saying that the production-increasing potentialities of improvements that were made over a decade, and that normally would have been diverted gradually into the production stream, were held back by the drought and depression of the 1930's. It was the breaking of these restraints that caused the flood of production in the war years--in the same way that a simultaneous breaking of dams on several tributaries will cause a river to reach flood stage from water that was accumulated from a normal flow at the source.

This accumulation of potential increases in production had escaped notice. The increase that was achieved was therefore much larger than could have been forecast from past trends. It was much greater than the increase that took place in World War I, because there was no similar accumulation of potential improvements at that time. Perhaps none familiar

with the South would have been so rash as to forecast, in the fall of 1941, that the acreage of peanuts picked and threshed would be nearly doubled in 1942, and that production for the years 1942-44 would average 176 percent of 1935-39. Likewise, none from the Corn Belt would have dared to forecast in 1941 that the production of soybeans harvested for beans in the years 1942-44 would be 339 percent of the production in 1935-39. Figure 2 shows the average 1942-44 production compared with prewar for some products in which major changes occurred. An optimistic advance estimate of wartime production probably would have averaged less than half of the increase that actually was achieved.

Mechanization is the most important factor back of the increased output of farm products for human use. The number of tractors on farms gradually increased from less than 250 thousand in 1920 to over 2 million in 1945. Increased use of mechanical power and associated equipment usually means more total production, but its most important effect is that a much larger share of the product goes to market. As mechanical power is substituted for draft animals, the land formerly used for horse and mule feed becomes available for producing commodities for human use. The shift to mechanical power from 1920 to 1945 made available about 55 million crop acres, or about 15 percent of the available cropland, for the production of marketable commodities. In World War I this large area of cropland and millions of acres of pasture had to be used for producing horse and mule feed.

Increased use of fertilizer and lime is another important factor in the wartime increase in production. Measured in plant nutrients (N,P_2O_5,K_2O), the total consumption of commercial fertilizer in 1944 was 85 percent above the quantity used in the prewar years 1935-39. Application of liming materials was nearly three times as large as in the prewar years. Based on estimates of additional output from increased use, it appears that the increased production resulting from the additional use of lime and fertilizer in 1944 accounted for 14 to 15 percent of the total increase in output since 1935-39.

Adoption of improved crop varieties was another important source of increased output. Use of hybrid seed increases the yield expectancy of corn about 20 percent; it added about 400 million bushels to the 1944 corn crop. New varieties of oats adapted for use in the Corn Belt and Lake States, and rust-resistant improved winter varieties for the Southern States, were widely adopted in the recent war years. Continued progress also was made in shifting to the more productive and more nutritious legume hays.

Total land used for intertilled crops increased by about 6 million acres, or 4 percent, from 1935-39 to 1944. In the same period the total cropland used for crops increased about 9 million acres, or 3 percent.

This is a rather small change and is therefore a minor factor in increased output. Other factors are much more important in accounting for the rise in production.

The building up of both livestock numbers and feed supplies in the years immediately preceding the war, and in 1942, made possible later marketings of livestock and livestock products especially in 1943 and 1944. Livestock production was increased also by the feeding of accumulated supplies of wheat, and of some imported wheat and feed grains. However, feeding of both the accumulated supplies and the larger imports accounted for only about 10 percent of the total concentrates fed to livestock in the year ended October 1, 1944. Thus by far the largest proportion of the livestock output came from current production of grain, forage, and pasture; and from an increase of more than one-half in oilseed meals for livestock feed.

Fortunately there were no major outbreaks of either plant or animal diseases or of insect damage in the years of World War II. The fact that no livestock diseases reached epidemic proportions despite record-breaking inventories of livestock was not only good fortune; it was also an indication of effectiveness of modern control methods, and of the vigilance of both farmers and technicians in controlling sporadic outbreaks. Insect damage was held to low levels despite shortages of such important insecticides as rotenone and pyrethrum.

With financial and patriotic incentives as encouragement, and with education and persuasion centered on virtually all-out production of strategic products, farmers and their families worked long hours and often utilized, to the best of their knowledge, every possible means of increasing output. Their efforts bore fruit so well that, even though about one-fourth of the food output went to military and other war emergency uses, there was food enough in 1944 and 1945 to provide our civilians with about 10 percent higher per capita food consumption than took place in the prewar years, 1935-39. In somewhat different terms, the output of food in 1944 was enough to feed about 50 million more people than the average quantity produced in 1935-39, assuming the same dietary levels for both periods.

That an increased number of people could be fed resulted partly from a change in the production pattern--more oil crops, beans and peas, and less cotton--and from a more complete utilization of the output. But the shifts in production, (fig. 2), that were necessitated by war needs, made increases in the total volume of production more difficult. Production per acre or per animal is usually lowered when a product is grown on land that is less suited for its production, or by growers who have insufficient experience.

The wartime increases in production were achieved with a constantly shrinking labor supply. The total farm population dropped from 30 million in 1940 to 25 million in 1945. Figure 3 shows the downward trend in farm employment and the contrasting sharp upward trend in production per worker. In 1944 farmers had 8 percent fewer workers than in 1935-39. Many of the hired workers that were available did not have the strength and skill that are usually considered necessary for farm work. If consideration is given to this fact, it is possible that the per worker effectiveness of the working force was not much more than 85 percent of prewar. But farmers and their families worked longer hours and, somehow, the job was done.

Figure 4 shows the changes in production per acre in relation to the changes in acreage of total cropland. The effects of all the forces that have resulted in increased production per acre are combined in this index. Similarly, the line showing production per animal unit of breeding livestock in figure 5 combines into one summary figure all the forces that have increased livestock production per animal. It shows the trend in production per unit of breeding stock. The shift to mechanical power and the increase in production per acre have made it possible also to increase the number of animal units of productive livestock. Thus the total increase in livestock production is derived both from larger numbers of breeding stock and from the increased output per unit of breeding stock as shown in figure 5. On the other hand, figure 4 shows that increased crop production is largely the result of higher production per acre because the changes in the acreage of cropland have been relatively small.

The increased output per acre and per animal, combined with mechanization, made possible the higher output per worker. The three series--production per acre, per animal, and per worker--summarize the startling changes that have taken place in farming since the years of the last war.

At the same time that progress in technology has increased output per man so tremendously in agriculture, the same phenomenon has occurred in industry. Figure 6 shows a somewhat more rapid increase in production per worker in the manufacturing and mining industries than in agriculture; but if data were available for the service industries they likely would show a less rapid climb. Increases have occurred in all sectors, however.

This poses the key question for the postwar years. Can peacetime industry and service occupations expand sufficiently to absorb at satisfactory wage levels (1) the workers returning from the military services, (2) the workers now in war industries, (3) the workers currently displaced by technological progress in both agriculture and industry, and (4) the net supply of new workers (after allowing replacements for death and retirement) that enter the labor market each year? This is a crucial question,

but before it is discussed in relation to peacetime agricultural production it is necessary to examine our recent wartime record more closely. And first of all, it seems desirable to compare changes in World War II with those that occurred in World War I.

Recent Wartime Increases Compared with Changes in World War I

World War I followed a period of expanding agriculture, but the markets for farm products had caught up with the expanded production before that war started in Europe in 1914. The export market had been large and profitable over a period of years, and the increasing population in this country had gradually absorbed a larger proportion of the total farm output. Machinery suitable for use with animal power was fairly well stabilized. Tractors were only in the early stages of adaptation for farm use. Most of the good virgin lands had been occupied before the advent of the war. Criticisms of the high cost of living with special reference to food and fiber were being heard in the cities. A back-to-the-land movement was being advocated by many people. Some of the current literature emphasized the importance of increasing output per acre in view of the fact that little new land was available for settlement and exploitation. 2/

Price and income incentives in World War I were favorable to increased output. Taking the years 1910-14 as a base, prices received by farmers for farm products in 1918 were 204 percent of those prewar years. By 1919 they were 215 percent. Prices of products bought by farmers also increased during the war, but at slower rates; and in 1918 and 1919 net incomes to farm operators reached new high levels. But with financial and patriotic incentives similar to those of World War II, and with the need for food just as urgent, the volume of output for human use increased only about 9 or 10 percent from the prewar years 1910-14 to 1918-19.

What are some of the reasons for the differences in production increases in the two war periods?

Although the most productive virgin lands had been brought into cultivation by the beginning of World War I, some new land was available for exploitation. Harvested cropland increased over 32 million acres from the years 1910-14 to the years 1918-19. This is more than twice as large an increase in harvested cropland as occurred from 1935-39 to 1942-44 in World War II. It should have resulted in greater increases in output at that time if other factors had been as favorable.

The foods receiving most emphasis in World War I were wheat and meat. In World War II there was much less emphasis on wheat, and

2/ See Farmers' Bulletin 406, "Soil Conservation" by W. J. Spillman, 1910.

relatively more on oil seeds, beans, and peas; and on meat, eggs, and dairy products. The products emphasized in World War II represented new products on many farms and so increases were somewhat more difficult to achieve than an increase in the products that are normally produced.

Wheat acreage in World War I was increased on new lands in the drier wheat-producing areas and it was substituted for other crops on the older lands of the humid areas in the Corn Belt and the Eastern States. The acreage of wheat harvested in the years 1917-19 in the five major Corn Belt States was 129 percent of the 1910-14 acreage. A new peak of harvested wheat acreage in the United States was reached in 1919 with 73.7 million acres.

Cattle numbers were at the low point of a cycle before the beginning of World War I in 1914, and steps were taken to encourage increases in cattle production, both on eastern farms and on the ranges of the Western States. The Forest Service was requested to increase the numbers allowed under grazing permits in the national forests. Under the stimulus of high prices and other incentives, cattle numbers on January 1 increased from a low of 56 million in 1912 to a high point of 73 million in 1918. For World War II the high point in cattle numbers was reached January 1, 1944 with 82 million on farms and ranches. But in comparing the two periods one must recall that the decrease in horse and mule numbers has released land equivalent to the acreage needed for maintaining 16.5 million head of cattle and calves.

Hog production also was stimulated in World War I, partly by a promise to maintain prices of hogs at a fixed ratio to corn at Chicago. In 1919 the number of all hogs on farms January 1 had increased 21 percent--from 53 million in 1914 (a low point in the hog cycle) to 64 million. In World War II, numbers on January 1 increased 68 percent from 50 million in 1939 to 84 million in 1944.

Despite the emphasis on wheat and meat in World War I, and the substitution of these products for other products in the farm economy, wheatless and meatless days were proclaimed. Adequacy of basic food supplies remained a critical war problem.

Weather was not so favorable during the years of World War I as in World War II. The wheat crop of 1916 was reduced by adverse weather and black stem-rust damage. In 1917 the crop was even smaller than in 1916 because of severe winter killing of winter wheat and of drought in some spring-wheat areas. Carry-over reserves were badly depleted by exports to Allied Nations. The wheat crops of 1918 and 1919 were nearly a third larger than in 1917, but these gains in wheat production became available chiefly after the end of the war.

Although manufacture of farm machinery was not limited by Government order as in World War II--in fact, its manufacture was encouraged until the fall of 1918--mechanical power was still of minor importance. Tractor power contributed only 2 percent of the combined work-animal and tractor-power units on farms, in 1919. Farming largely with animal power meant that much land which now produces marketable products was needed for horse and mule feed, and that reserve power for long hours of field work, and for timeliness of operations, was not available.

Because potash fertilizers had been imported from Germany, there was a serious shortage of this plant nutrient during World War I. The available supply in 1918 was only about one-fourth of that used annually in the immediate prewar years. Nitrogen supplies were also short. In fact, total use of fertilizer was considerably reduced in the early part of that war period and, although it increased somewhat in 1918-19, it did not reach the levels of 1914 at any time during those war years.

Plant and animal diseases and insect pests took a proportionately greater toll of potential production in World War I than in World War II. The boll weevil caused extensive damage to cotton in all of the years of the first war. Black-stem rust seriously affected wheat production in 1916. Outbreaks of hog cholera were numerous from 1911 to 1915 and again in 1919.

The situation in World War I as compared with World War II can be summarized in this way. More sod land that could be broken up and put to use was available but on the intensive side (increases in output per acre and per animal) production was limited by shortage of fertilizer, lack of mechanical power, damage by plant and animal pest and disease, and somewhat unfavorable weather. There were no innovations such as hybrid corn that could be seized upon to increase production quickly. The background of agricultural research was more limited, and organized extension teaching was in its early stages in most States. In other words, the same favorable conjuncture of circumstances that prevailed in World War II did not develop in World War I.

It should be emphasized that, aside from weather, all of the physical conditions more favorable to increased production in World War II have grown out of invention and research, and have been spread by the education and operations program of the interwar and World War II years. The cumulative value of agricultural research and of extension teaching in making possible the increase in farm output in World War II can hardly be overestimated. And the stimulation given by operations programs to conservation practices and increased use of fertilizer must not be overlooked.

FOUNDATION FOR INCREASED PRODUCTION

An examination of production changes in the interwar years clearly indicates that the foundation for wartime increases in production was built up in the 20-year period between the two world wars. It was built on the tremendous improvements that have been made in mechanization, in land use, in conservation, fertility, and cultural practices, in development of new crops and new varieties and in increasing the efficiency of livestock production.

The cumulative effect on the total volume of production was not realized because of drought and because markets were not available for greatly increased quantities of farm products. We have seen that although gross farm production (including farm-produced power) increased slowly during the 1920's, it dropped precipitously during the drought of the early 1930's (fig. 1). Later farm production reached its new peak in 1937 and remained relatively high in 1938 and 1939. But for the 20 years from 1919 to 1939 the annual gross farm production increased only 9 percent, whereas it increased 18 percent in the 5 years from 1939 to 1944.

Except for the severe drought years, farmers obviously could have produced more in the 1930's if markets had been available at prices profitable to farmers. But despite the brake placed on increases in production by the low prices and resulting crop-adjustment programs, it seems evident that the total volume would have risen sharply in the early 1940's even without the incentive of wartime prices and needs. The production potential was built up in the late 1930's to the point where accelerated increases in production were almost inevitable.

The stimulation of war needs--the patriotic urge to increase production, the doubling of farm prices, and tripling of net incomes to farmers--pushed production faster and farther than it would have gone under peacetime conditions. But this greater acceleration was physically possible only because of the foundation that had been laid in the interwar years.

Changes in the Use of Farm Machines

The rapid shift from animal power to mechanical power for farm production in the interwar period constituted one of the most important changes that has ever taken place in American agriculture. It was a cornerstone in the foundation for increased wartime production. The rather small increase in gross farm production during the interwar years (9 percent from 1919 to 1939) is to be contrasted with farm output (the measure of production which excludes farm-produced power) which increased 25 percent from 1919 to 1939. This higher increase in farm output was the result of transferring resources from the production power on the farm to the production of livestock and crops for sale in the market.

To the approximately 50 million acres of cropland released by the shift from animal power to mechanical power in these decades another 5 million acres were added in the years 1940-45. This release of cropland for the production of marketable products is of course the most startling effect that mechanization has had on American farms.

But other effects are also striking. The shift to mechanical power and associated equipment brings an increased output per worker both by enabling him to do the job faster and by doing a better job of tillage or other operations and in that way realizing more benefit from other improved practices. The physical burden of farm work is lessened because the drudgery of hand labor is eliminated. Fewer workers are needed in farm production. Physical strength becomes relatively less important, and mechanical skill becomes more necessary in the performance of farm work.

The effects of the greater timeliness in farm operations that is possible by mechanization are difficult to measure, but obviously the result is both greater total production and higher quality of farm products. As power equipment can cover more acres per hour and can also be used longer hours if necessary, it has enabled farmers to do critical jobs without the delay that frequently occurred when horse equipment was used. For example, the quick coverage possible in spraying potatoes with a multiple-row power sprayer may salvage a crop that otherwise would be seriously damaged.

Perhaps the best illustration of the contribution of mechanical power to timeliness of operations is the experience in the Corn Belt with unfavorable weather at planting time in each of the years 1943 to 1945. The spring of 1943 was exceptionally wet, and planting was seriously delayed in many areas. Illinois usually receives 4.10 inches of precipitation in the month of May, but in 1943 it had 8.75 inches--more than twice the average rainfall. Rainy weather prevailed throughout the month and so retarded field work that only about 15 percent of the corn had been planted at the end of May, when planting is usually completed.

With a tractor and power equipment 3 acres of land can be prepared and planted to corn during the time that one acre is planted with work animals. If the tractor is put on a 24-hour schedule, which is not feasible with work animals, the preparation and planting job can be done seven times as fast as with animal power. By utilizing all available mechanical power and equipment (sometimes on a 24-hour schedule) farmers were able to complete their preparation of land and planting of corn in record time during the early days of June in 1943. It was estimated that 85 percent of the corn was planted by June 15.

If tractor power had not been available some of the corn would never have been planted because it could not have been planted until it

was too late to obtain a crop that year. Tractor power saved the day and, with favorable weather during the rest of the season, Illinois produced 419 million bushels of corn, one of the largest crops on record.

Weather conditions similar to those experienced in 1943 prevailed in many areas of the Corn Belt in 1944 and again in 1945, yet the yields were large. It is apparent that the contribution to production of greater timeliness is one of the real benefits of mechanization, even though it is difficult to measure in quantitative terms.

The rate of adoption of mechanical power and associated equipment has varied considerably in different periods. The number of tractors on farms increased sharply during World War I, despite the fact that these tractors were cumbersome, slow moving, and expensive to operate (fig. 7). They were adapted only for the heavy tillage and harvesting operations and for belt work. Farmers had to keep work animals for other farm operations, which meant a considerable duplication of power. After 1920, the rate of increase in tractors on farms slowed down for 2 or 3 years, until the general-purpose tractor was introduced. It was suitable for the cultivation of row crops and for other farm tasks as well as for the tillage and harvesting work.

This revolution in tractor design, along with improvements that were made in standard wheel tractors and crawler tractors for heavy operations on large farms, brought a considerable spurt in tractor purchases, and a rapid increase in tractors on farms from 1925 through 1930. The numbers increased only slowly from 1930 to 1932 and actually were below 1932 numbers in the drought and depression years of 1933 and 1934. With the beginning of the agricultural recovery in 1935, the number increased very rapidly. The sharp upward climb continued throughout the late 1930's and the early 1940's. War limitations on the manufacture of tractors slowed down the rate of increase, especially from 1943 to 1944, but the numbers on farms increased each year during the war, and on January 1, 1945 they totaled 2,072,000.

The introduction of rubber tires for tractors and associated power equipment during the 1930's started a rapid and steady advance. It greatly facilitated the use of tractor power for many farm tasks and lowered the cost of tractor operation. Perhaps an even more valuable development in the 1930's was the redesigning of farm machinery for use with tractor power. When tractors were introduced, the machinery that had originally been designed for use with horse power was adapted to tractors by making special hitches and some other minor changes. The complete changes in design of equipment to facilitate use with tractor power have come only within the last few years.

In summary, the three most important technical developments that stimulated mechanization in the interwar years were: (1) introduction of the general-purpose tractor adapted for use on smaller farms and for a wide variety of farm jobs, (2) introduction of rubber tires for tractors and other machines, and (3) design of equipment for use with tractors. These developments accelerated the shift to tractor power, and stimulated the adoption of combines, corn pickers, and other tractor-drawn machines. They reduced the cost of operation, for both depreciation and maintenance. Improvements in construction of both tractors and associated equipment have enabled farmers who are relatively unskilled at mechanical work to operate power equipment without serious disadvantage.

Substitution of tractors for horses and mules has not taken place at uniform rates over the entire country. Figure 8 shows, by regions, the number of tractors on farms in 1920, 1930, 1940, and 1945. That the rate of adoption has been more rapid in the Corn Belt, the Great Plains, the Mountain, and Pacific States than in the East and South is evident. Figure 9, showing the distribution of tractors on farms in 1940, indicates the relatively greatest concentration of tractors in the Midwest and in smaller areas in other parts of the country. Table 1 shows the number of tractors per 100 acres of total cropland, by census geographic divisions, in 1920, 1930, and 1940 to 1944. This table indicates that the Northeastern States are relatively well supplied with tractors in relation to cropland. But the average acreage of cropland per farm is less there than in the Midwest, and the number of tractors per 100 farms in the New England States in 1940 was only about half the number for that many farms in the West North Central States.

The Southern States have the fewest tractors per 100 acres of cropland. But it seems probable that tractor power will be adopted at rapid rates in the next few years by southern farmers. Purchasing power in the South has been built up during the war. Labor has shifted to nonfarm work in large numbers, and the new small and versatile tractors are well adapted to small farms and rolling land.

The first column in table 2 gives the number of tractors, by census divisions, for 1944. The second column is a projection of the number of tractors there will be on farms in 1950, assuming the same increase per region in number of tractors as occurred from 1940 to 1945 when there was a total increase of 527,000 tractors on farms. On this assumption, there will be nearly 2,600,000 tractors on farms in 1950. The third column is a projection to indicate the number of tractors there will be on farms, by 1950, if farmers in the South Atlantic and East South Central regions buy enough tractors from 1945 to 1950 to have the same number per 100 acres of cropland in 1950 as the Middle Atlantic States had in 1944, and if farmers

Table 1.- Number of tractors per 100 acres of total cropland by census divisions, 1920, 1930 and 1940 to 1944

Census division	Tractors per 100 acres of total cropland						
	1920	1930	1940	1941	1942	1943	1944
New England	.05	.36	.77	.85	.94	.98	1.03
Middle Atlantic	.08	.56	.92	.97	1.04	1.11	1.16
East North Central	.09	.43	.78	.82	.90	.92	.92
West North Central	.07	.22	.40	.43	.47	.48	.47
South Atlantic	.03	.17	.22	.23	.27	.28	.29
East South Central	.02	.09	.16	.17	.19	.20	.20
West South Central	.04	.12	.29	.30	.36	.38	.39
Mountain	.08	.17	.29	.30	.33	.34	.34
Pacific	.11	.34	.50	.51	.55	.55	.56
United States	.06	.24	.43	.45	.50	.52	.52

Table 2.- Number of tractors by census divisions: 1944 and projected for 1950 on certain assumptions

Census division	1944	1950 with same increase as from 1940 to 1945 1/	1950 with accelerated increase in Southern States 2/
	Thousands	Thousands	Thousands
New England	37.5	52.7	52.7
Middle Atlantic	157.5	214.1	214.1
East North Central	540.7	706.4	706.4
West North Central	655.1	833.6	833.6
South Atlantic	84.3	130.2	337.2
East South Central	55.3	84.1	320.8
West South Central	218.3	303.4	333.7
Mountain	96.3	131.0	131.0
Pacific	108.0	142.5	142.5
United States	1,953.0	2,598.0	3,072.0

1/ Assuming the same increase in number of tractors in each region as for the years 1940 to 1945.

2/ Assuming that tractors are increased in the South Atlantic and East South Central States to the same number per 100 acres of cropland as there were in the Middle Atlantic States in 1944. The numbers in the West South Central States are increased 10 percent more than the increase, 1940-45. The increase in other States is the same as in column 2.

in the West South Central region buy 10 percent more tractors than they did from 1940 to 1945. The number of tractors in the other regions is the same as in column 2. On this basis, there will be more than 3 million tractors on farms by 1950. If purchases are accelerated in the South it seems likely that the rate of purchase also will be stepped up in other regions; but perhaps the increase assumed for the Southern States in column 3 of table 2 is higher than actually will materialize.

As the numbers of tractors on farms are increased the over-age horses and mules will be disposed of. The colts that are being raised are not sufficient to maintain horse and mule numbers of working age at present levels. Even if tractors do not increase in numbers faster than they did in the years 1940 to 1945, the number of horses and mules 3 years old and older is not likely to exceed 9.7 million head by 1950. And the total number of horses and mules seems likely to drop to 10.6 million. This reduction in horse and mule numbers would release another 5 million acres of cropland to produce products for the market.

In considering the importance of mechanical power on farms one must not forget the use of automobiles and trucks to speed up the transportation job both on the farms and from farms to market. Figure 10 shows the increase in numbers of trucks and automobiles, 1910-45. It is apparent that automobiles and trucks on farms have increased in about the same way as tractors, except for larger dips in the depression years of the early 1930's, and for a shrinkage in numbers during the war years. As soon as new automobiles and trucks can be bought it is expected that numbers on farms will increase again.

Wartime shortage of labor stimulated the attempts by farmers to buy more and more labor-saving equipment. Limitations on the manufacture of tractors and other farm machines held down the increase in farm mechanization, but despite these restrictions there were notable increases in labor-saving equipment on farms during the war. For example, the number of tractors on farms increased 34 percent from 1940 to 1945. In the same period the number of grain combines increased 74 percent; corn pickers, 53 percent; and milking machines, 117 percent. If more new machinery had been available during the war the process of mechanization would have been more complete, especially in the Southern States, and farm output could have gone even higher, or more workers could have been released for war industry.

With removal of limitations on manufacture of machinery farmers are likely to increase their purchases considerably, and by 1950 there may be at least 2,600,000 tractors on farms. Associated power equipment will increase somewhat in proportion to the increased number of tractors.

Farm use of central-station electric power has expanded rapidly, even in the war years. From 1940 to 1945 there were more than 650,000 new installations on farms. In 1945, over 45 percent of the farms in this country had central-station electric power, as compared with 26 percent in 1940 and 9 percent in 1930. Figure 11 shows the percentage of the total number of farms in each State that had central-station electric power in 1945. It is expected that farm electrification will increase rapidly within the next 5 years. Its use in farm production is mainly as a source of stationary power around the farmstead, but the contribution of electric lights and heat to the production of poultry and hogs and to some other enterprises should not be minimized.

Home uses of electricity are of major importance. Electric power for lighting the home and for cooking, washing, ironing, and other household work lightens the workload for the housewife. And such home equipment as refrigerators and deep-freeze units supplement farm production by providing for better utilization of farm products, both for home use and for sale.

The impact of mechanical power and associated equipment on the transformation of agricultural production in the interwar and war years may well be compared with the agricultural revolution that followed the introduction of improved machinery for use with animal power. The steel plow, the mower, the reaper, and later the self binder, were the primary developments in the animal-power phase of mechanization, which began about 1830 and was well stabilized by the beginning of World War I. The mechanical-power phase had then begun, but it did not gain full momentum until that war was over, and the really noteworthy effects have come in recent years.

In fact, the mechanical-power phase of farm mechanization has not yet been stabilized. Wheat production is almost completely mechanized and corn production is well on the way in the main producing areas. Hay harvesting is in a state of flux, with several radically different methods of competing for adoption in all the chief hay-producing areas. Mechanization of the cotton harvest is only in its beginning stages, and tobacco is still a hand-labor crop. Considerable progress has been made in labor-saving equipment for the dairy enterprise but relatively less attention has been given to improvements in housing and other equipment for the livestock enterprises than for crop production. Advances in this domain promise to yield substantial savings in capital investment as well as in the labor used.

A look at the new mechanical developments that are already on the horizon leads to the conclusion that the new impacts of mechanization on

agricultural production will be just as influential in the decade 1946-55 as were those of the preceding decade. Two of the major developments will be the increase in number of tractors, especially the small sizes fitted with equipment suitable for use on small farms; and the fairly rapid adoption of mechanical cotton pickers. These developments, along with many others, will have far-reaching repercussions on production and on the number of workers that will be needed in agriculture.

Changes in Land Use, Conservation, and Rotation Practices

Many changes in the use of cropland and permanent pasture took place between the World Wars. In the early part of this 20-year period the rather extensive abandonment of land in the Eastern States was offset by the development of new lands in the Western States. Total cropland acreage in the United States was a little lower in the early 1920's than in 1919, but it rose slowly from 1927 to 1931 (fig. 12). From 1932 to 1939 the trend was downward. Total cropland remained at about the low point reached in 1939 until the war year of 1943; then the total increased to within about 1 percent of the 1928-32 peaks.

Acreages of harvested cropland have been more erratic (fig. 12). The effects of the droughts of 1934 and 1936 are especially apparent. The drought's impact was most severe in the Great Plains and Intermountain States, where much of the sod land that had been broken out in the 1920's was abandoned in the 1930's. Some of it was again brought into use during the war.

Changes in harvested acreages of principal crops in the Great Plains, the Mountain, and the Pacific Northwest States are apparent in figure 13. These States contain the chief wheat-producing areas of the country. It is evident that "the plow that broke the Plains" broke much of it in the decade following World War I. In these States the ratio of crop acreage to improved land in farms was considerably lower in World War II than in the years preceding the drought and depression of the 1930's.

Changes in the principal uses of cropland from 1928-32 to 1935-39 and to 1944 are shown in table 3. These cropland figures include rotation pasture but do not include wild hay, orchards, vineyards, and farm gardens. It is apparent that the acreage of intertilled crops decreased, while the close-growing crops held about the same level in the years 1928-32 and 1935-39. The acreage in sod crops decreased from 1928-32 to 1935-39 because of drought and loss of seedings. There was a 4-percent increase

Table 3.- Changes in the principal uses of cropland in the United States--
1928-32, 1935-39 and 1944

Use of cropland	Average 1928-32 1/ 2/	Average 1935-39 2/	1944 2/	Percentage 1944 is of	
				1928-32	1935-39
	Million acres	Million acres	Million acres	Percent	Percent
Intertilled crops 3/	176.6	163.0	168.8	96	104
Close-growing crops 3/	132.6	133.0	129.8	98	98
Sod crops 3/ 4/	77.3	73.5	80.2	104	109
Total cropland used for crops	386.5	369.5	378.8	98	103
Summer fallow and idle cropland	41.3	56.9	47.3	115	83
Total cropland 5/	427.8	426.4	426.1	100	100

1/ The data on which the 1928-32 estimates are based are less complete than for later periods.

2/ Planted acres insofar as available; all others harvested acres.

3/ Adjustments made for multiple use of land by considering first use in the crop year as the primary use.

4/ Including acres in tame hay, hay and cover-crop seeds, and in rotation pasture.

5/ Includes rotation pasture, but does not include wild hay, orchards, vineyards, and farm gardens.

in the acreage of intertilled crops from 1935-39 and to 1944. The acreage of close-growing crops was decreased, but the sod crops (hay, hay and cover-crop seeds, and rotation pasture) more than held their own.

Further shifting to sod crops may take place in the next few years, as farmers realize the importance of hay and pasture in a soil-maintaining system of farming. In the humid areas crop rotations that contain a combination of intertilled, close-growing, and sod crops are more likely to maintain fertility and to sustain high crop yields over a period of years than does single cropping, or a too-great concentration on intertilled crops. Only a part of the evidence of the sacrifice made in postponing crop rotations during wartime is found in the larger acreage of intertilled crops. The five principal Corn Belt States apparently had at least 1.5 times as many acres of intertilled crops that were repeated 2 or more years on the same land as they had in the immediate prewar years. A cropping program designed to maintain soil resources should reduce considerably this succession of intertilled crops.

In many areas of the Great Plains, the Intermountain, and the Pacific States a part of the cropland acreage needs to be in summer fallow, as a means of storing moisture and of making plant nutrients more readily available. In the wheat areas of the Pacific Northwest the practice of summer fallowing has been followed for more than half a century. In the Palouse area proper, where annual precipitation is 18 or more inches, summer fallowing has not been necessary for moisture storage, and dry field peas are now grown on much of the acreage that formerly would have been summer fallowed. Interest in summer fallowing in the Great Plains was not great until the early 1920's. It apparently started in Montana, Wyoming, and Colorado, and extended farther east in the late 1920's and early 1930's, under the pressure of recurring droughts.

Accurate estimates of the acreage of summer fallow by States are not available but table 4 is believed to be indicative of the general trend. For the seven Western States the fallow acreage has remained substantially the same since 1928-32. Substitution of field peas for fallow in the Pacific Northwest has apparently been offset by moderate increases in wheat acreage in the drier areas where fallowing is necessary to produce a crop. In the Great Plains States, however, summer fallowing reached a peak of 17.4 million acres in 1939--more than six times greater than the average acreage of the years 1928-32. With increased need for wheat in wartime, both as food and as feed, and with more rainfall, fallow acreage dropped by 1944 to around 11 million acres. Some reduction was justified as a wartime expedient but any widespread resumption of the

Table 4.- Estimated acreage in summer fallow for selected States and periods

Period	7 Western States 1/	10 Great Plains States 2/	Total 17 States
	Million acres	Million acres	Million acres
1928-32 3/	5.5	2.8	8.3
1939 4/	5.4	17.4	22.8
1942 5/	5.3	14.4	19.7
1943 5/	5.6	12.2	17.8
1944 5/	5.5	10.8	16.3

1/ Washington, Oregon, Idaho, California, Nevada, Utah, and Arizona.

2/ Montana, Colorado, Wyoming, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas.

3/ Based largely on an unpublished study of the Bureau of Agricultural Economics, 1939.

4/ Agricultural Census data for idle and fallow acreage with fallow estimated by applying ratios from rural-carriers survey made for the Bureau of Agricultural Economics.

5/ Estimates of Production Adjustment Committees in each State.

practice of continuous cropping to wheat would soon result in a smaller total wheat crop and would at the same time deplete fertility reserves considerably.

Since 1936, payments have been made under the Agricultural Conservation Program to cooperating farmers for each acre of protected summer fallow. In some States the payment was made for ordinary summer fallow, provided the surface was ridged or stubble mulch was left to prevent erosion. In others, strip fallowing across the direction of prevailing winds or on the contour were the only practices recognized for payment. Farmers in most wheat-producing areas of limited rainfall are now convinced of the value of these practices.

In addition to payments for summer fallow the Agricultural Conservation Program has paid cooperating farmers for carrying out a wide variety of soil-building practices in all regions. Among the more important are contour tillage, strip cropping, terracing, and use of green manure and cover crops.

Steady growth is indicated in the adoption of contour operations, the big bulk of which has occurred in the South. Contouring not only lessens the damage from water erosion but is likely to bring increased crop yields, particularly in areas where lack of sufficient moisture tends to limit the production.

Seeding of green manure and winter cover crops are practices that protect against erosion losses, contribute in some instances to the supply of available pasture, and increase crop yields through the return of substantial quantities of organic matter to the soil. They are particularly valuable in the more humid areas where a fall-harvested intertilled crop would otherwise leave the land bare, and subject to soil washing in the winter. As yields are maintained or increased through such practices, their rapid extension has no doubt contributed significantly to total agricultural production. The acreage of winter cover crops in the Southern States was about four times larger in 1944 than in prewar years. Adoption of these practices might have been even greater if larger supplies of the preferred cover-crop seeds had been available.

Although terracing has been done most extensively in the South, the rate of construction of new terraces has declined moderately there since 1938. It is possible for a farmer to build his own terraces with simple equipment, but technical assistance is necessary in laying out the contour lines, and much of the earth-moving is done more satisfactorily with heavy mechanized equipment. This more costly practice may be

considered as a capital improvement and, as such, it was delayed by many farmers until after the war. Changes in farming systems in the South which result in a smaller proportion of intertilled crops may permit the development of rotations that will make terracing less necessary in some areas.

More than half the farms in the United States are now included within the boundaries of Soil Conservation Districts. By the end of 1943, farmers and technicians had jointly developed long-time conservation plans on more than 200,000 of these farms, containing more than 54 million acres. The principal practices applied on these farms are contour cultivation, terracing, strip cropping, crop-residue management, and grass planting. Not all farmers in Soil Conservation Districts will formulate definite conservation plans. But the farms on which such plans are applied will serve as demonstrations to their neighbors, and conservation practices that prove their worth will spread voluntarily to other farms.

Changes in permanent pasture are much more difficult to trace than changes in cropland. Considerable improvement of permanent-pasture areas was carried out from the middle 1930's and up through the war years. Liming, fertilization, and establishment of new pasture, were the main improvements in the humid areas. In the range areas attention centered on stockwater development, reseeding, and rotation grazing.

Relatively favorable weather for forage growth made it possible to sustain a large livestock population on the western ranges during the war. If years of lower precipitation should come it would be necessary to reduce the numbers, but in the areas where major improvements have been carried out the long-time carrying capacity has been increased.

In many humid areas the possibilities for further improvement of permanent pasture are great. It seems probable that much of this improvement will be undertaken in the early peacetime years--part of it in response to the stimulations furnished by conservation programs.

Changes in Liming and Fertilizing Practices

Use of lime and commercial fertilizer was greatly increased in the immediate prewar and war years. A considerable part of the larger farm production can be attributed to the greater use of these materials. But of about equal importance is the potential contribution of lime and fertilizer to the establishment of stable and soil-maintaining systems of farming.

Information on use of liming materials is not available for the years before 1929, when the tonnage of lime used was about 60 percent of the 1935-39 level. The tonnage used annually was about doubled from 1935 to 1936, the year when lime was first included in the Agricultural Conservation Program. Figure 14 indicates that the use of liming materials in the later war years was nearly three times the prewar levels, despite the difficulties in obtaining labor and trucks for crushing and hauling.

Annual use of lime will need to be increased in postwar years if all of the land in the humid regions that needs lime for soil-maintaining crop rotations is to receive an initial application, and if adequate maintenance applications are made thereafter. It has been estimated that the tonnage of lime applied annually would need to be about 2.5 times the 1943 level, after all the land needing lime has received an initial application. Before that point, a larger annual tonnage would be needed because the initial application is made at a higher rate per acre in some areas. 3/

On many soils in the humid regions it is necessary to apply lime in order to get full use of commercial fertilizer, especially the phosphates. And lime and phosphate applications are required for successful stands of the legumes and grasses that are so necessary in a good crop rotation, and for soil maintenance. Some of the increase in use of commercial fertilizer is accounted for by the greater use of phosphates in combination with liming materials for hay and pasture improvement in late years. Nearly all of the fertilizer distributed by public agencies has been applied on legumes and on hay and pasture lands. But even the relatively large wartime distribution of fertilizer by public agencies accounted for only 10 percent of the total value of the fertilizer that was used.

The increase in the consumption of fertilizer in the war years was an acceleration of a long-time upward trend that was interrupted in the severe depression of the early 1930's (fig. 15). The largest part of the increase has been applied to the cash crops, although a growing proportion of the fertilizer now goes on legumes and grasses.

During the war many farmers who had not previously used commercial fertilizer learned how to use it to increase their production. It was used in areas and on crops where it had not been used before. This

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3/ See "Peacetime Adjustments in Farming--Possibilities Under Prosperity Conditions," U. S. Department of Agriculture Misc. Pub. 595, 1945.

experience is likely to mean a much higher level of use in the peacetime years ahead. Lower prices for farm products undoubtedly would mean some decrease in purchases of fertilizer for cash crops, but it does not seem at all likely that sales would drop back to prewar levels.

From the standpoint of maintenance of land resources the Nation is vitally interested in the use of lime and fertilizer for the establishment of crop rotations that contain sufficient acreages of grasses and legumes. Greatly increased consumption of lime and fertilizer for this purpose would help in the establishment of more stable systems of farming, and would lessen the emphasis on those staple cash crops that are pressing most heavily on market outlets.

State Committees that were studying postwar adjustments suggested that, under favorable price conditions, it would pay farmers to use about twice the quantity of plant nutrients in the form of commercial fertilizer that was used in the war year 1944. 4/ A much larger proportion of it would be used for small grains other than wheat, however, and for legumes, hay, and pasture. These uses would be more than tripled from their wartime levels. If such a program were carried out it would make a substantial contribution to farming stability, and to maintenance of land resources. But these large increases in the use of fertilizer would not take place without strong educational and other programs that are designed to accelerate the use of lime and fertilizer in soil-maintaining rotations.

In common with most other improved practices, greater use of lime and fertilizer, especially on cash crops, would increase the volume of farm products that goes to market, which in turn would tend to reduce the prices of the products that would be produced in greater volume. But the farmers who use the fertilizer would have lower costs per unit of product and an increased volume as an offset to lower prices. And it is to be remembered that insofar as the increased use of these materials promotes soil-building rotations the emphasis is shifted away from the staple cash crops that are likely to be overproduced. Such shifts therefore might actually aid in avoiding market gluts of some products. Moreover, part of the increase in lime and fertilizer constitutes a capital investment in permanent soil improvement that is in the interest of future welfare, both for individual citizens and for the Nation as a whole.

4/ See "Peacetime Adjustments in Farming-Possibilities Under Prosperity Conditions," U. S. Department of Agriculture Misc. Pub. 595, 1945.

Changes in Crops

The greatest contribution of crop and variety changes to increased war production was the interwar development of improved strains and varieties that greatly increased the yields per acre of our most important crops. Hybrid seed corn is an outstanding example.

In the war years the most significant expansion of the strictly war crops was in hemp for hard fiber. Its harvested acreage was increased from 1,246 acres in 1935-39, grown mainly in Wisconsin and Kentucky, to 146,200 acres in 1943 when hemp was grown in several Midwestern States. A government corporation was organized to contract for acreage in suitable areas, and to construct and operate hemp-processing plants in the new producing localities. Different kinds of vegetable seeds, mung beans, castor beans, and some pharmaceutical plants were grown to alleviate or to protect against war shortages. These were important war crops. But they were concentrated in small areas, they occupied only small acreages, and they constituted a rather insignificant part of the total volume of agricultural production.

On the other hand, large contributions to wartime production were made by increasing some crops that were of minor importance in the interwar years. Soybeans were the most important among this group. They are one of the oldest of the cultivated crops but their production in this country has occurred mainly in the twentieth century, and commercial production of soybeans has been developed mostly since 1920. The acreage grown for all purposes increased from about 50,000 in 1907 to 460,000 acres in 1917. But in the latter year the output of most of the acreage harvested for beans was used for seed. The acreage harvested for beans to be used both for seed and for crushing expanded from 448,000 in 1924 to 10.4 million in 1944. The acreage harvested for beans in 1944 was 241 per cent of that acreage in 1939. About half of this increase represented a shift from harvesting soybeans for hay to harvesting for beans. Most of the increase in soybean acreage took place in the Corn Belt, although large percentage increases occurred also in the Mississippi Delta and in the Atlantic Seaboard States of North Carolina, Virginia, Maryland, and Delaware.

In the Corn Belt the crops replaced by soybeans were mostly small grains, hay, and rotation pasture. During the interwar years some of the land previously devoted to corn had been shifted to soybeans, but during World War II corn and soybeans increased concurrently. On the whole, soybeans have replaced crops that have lower volumes of output per acre so the shift has added to the total volume of production.

Figure 16 shows the growth in acreage of soybeans harvested for beans from 1924 through the war years. It brings out the preeminence of the Corn Belt in the soybean enterprise. But the acreage trends are only part of the story. The trend in yield per acre has been upward, and by far the highest yields have been obtained in the Corn Belt. Thus in the years 1940-44 the five Corn Belt States had 83 percent of the acreage harvested for beans and 88 percent of the total production.

New varieties of soybeans, especially the Lincoln, give promise of further increases in yield per acre within the next few years. The levels of wartime acreage are not likely to be maintained when other sources of oil become more readily available, but it seems probable that both acreage and production will remain at higher levels than they reached before the war. Soybeans in the Corn Belt have a nearby market for meal, which usually equals or exceeds the value of the oil, so the oil may become the byproduct from soybeans grown chiefly to supply high-protein concentrates. On this basis they can compete more readily with other sources of edible oil.

Peanuts are not a new crop, even in this country, but they were given increased emphasis during the war, and they made an important contribution to the wartime food supply. Only relatively small proportions of the peanuts have been crushed for oil, however; most were used for nuts or other direct food products such as peanut butter.

Figure 17 shows the acreage of peanuts grown for all purposes, the acreage picked and threshed, the yield per acre and production for the years 1909-45. The acreage of peanuts picked and threshed nearly doubled from the prewar years 1935-39 to 1944. As the acreage expanded, into new areas and on farms of new growers in old areas, the average yield per acre decreased. In many areas new producers obtained relatively low yields until they had become familiar with the crop.

Figure 18 shows changes in acreage, yield, and production by major producing areas. In the Oklahoma-Texas area the acreage was 4.3 times the prewar levels in 1943 but in 1944 it dropped back to 3.4 times the acreage in 1935-39.

The market for edible peanuts may remain relatively high in the postwar years. But as an oil crop peanuts are likely to face keen competition that can be met only by prices that are in line with comparable oils. Perhaps more mechanized production practices can help to give competitive strength to peanut production. A much larger proportion of the total peanut acreage is likely to be hogged off as time goes by.

Flaxseed was the third oil crop that was greatly expanded during the war. The 6.3 million acres planted in the peak year 1943 was more than three times the average of 1935-39, but the acreage planted in 1944 dropped back to less than half that of the previous year, and in 1945 special acreage payments increased the planted area to 4.1 million acres (fig. 19).

Most of the flax is produced in spring-wheat States where it was formerly grown as a new-land crop in Minnesota, North Dakota, South Dakota, and Montana. Weed-free land is needed for successful production. Flax is considered a hazardous crop compared with its alternatives. In the drought year 1936 more than 80 percent of the planted acreage was abandoned in the Dakota-Montana area. As compared with the opportunity to grow an unlimited acreage of wheat at loan-rate prices, farmers in the spring-wheat States would have hesitated to take a chance on flax without the special financial inducements that were offered.

Flax yields per harvested acre were higher during the war than were experienced in 1935-39. In 1943 and 1944 they were more than 50 percent higher in the Dakota-Montana area. Flaxseed production, on the larger acreage and with the higher yields, in the years 1940 to 1945 ranged from two to nearly five times the 1935-39 level. In 1943 the Dakota-Montana area produced more than 8 times as much flax as in 1935-39.

It seems unlikely that flax acreage will be maintained at wartime levels without special price or production incentives. On the other hand, it might be stabilized at levels above the 1935-39 acreage, which was extremely low because of the drought. The acreage planted to flax in the Dakota-Montana area will depend largely on the profitableness of wheat production.

Dry edible beans and dry peas are sources of vegetable proteins that can be substituted, to some extent, for the animal proteins. As they also can be readily stored and transported, these direct food crops are well suited for war and relief needs.

The dry-bean acreage increased from the 1,917,000 acres planted in 1935-39 to 2,673,000 in 1943, which was the peak year. In 1944, the planted acreage dropped to 2,196,000 acres, and in 1945 it was down to 1,976,000 acres. Yields were disappointing in many of the new producing areas; and the competition of other cash crops was too keen to maintain the bean acreage at the high level reached in 1943.

In contrast to beans most of the dry peas are grown as a supplement to other crops rather than in competition with them. Where the annual precipitation is 18 inches or more peas can replace summer fallow on the weat lands of the Pacific Northwest. Somewhat lower yields of wheat are experienced in a wheat-pea than in a wheat-fallow sequence, but the returns from wheat and peas are usually much higher than from wheat and fallow. This was especially true during the war, when prices were supported at $5.65 per hundredweight for No. 1 peas at country shipping points.

Peas are also a highly mechanized crop, and use about the same machines as wheat. They therefore supplement wheat production with respect to both land and machinery. And, as labor requirements per unit of product are low, the output per unit of additional land, equipment, and labor resources is high. This is true only in certain areas, however, and is true there only to the extent that peas can be grown as part of the wheat-pea sequence. Expansion beyond that point means that peas have to be substituted for wheat and grown in succession, or that they replace other crops in other producing areas.

At the beginning of World War II considerable acreage was available for expansion of peas on the basis of supplementary use of resources. Figure 20 shows how rapidly the acreage of peas expanded during the war. The peak was reached in 1943 with 832,000 acres. This was a much larger acreage than could be produced as a supplementary crop, so some land grew peas in successive years, not only at the expense of wheat but also at a sacrifice of soil maintenance. Peas also were grown in some areas that were not well suited to them. The 731,000 acres planted in 1944 represented a closer adjustment of pea acreage to desirable wartime use of resources.

There is no foreseeable domestic food demand in peacetime years for the quantity of peas that were grown during the war. They could be grown for a high-protein livestock feed, but the price would be much below wartime levels if they were to compete with other protein feeds. It seems likely that acreage will decline considerably, but it might stabilize at somewhat higher levels than the prewar average.

A crop change that developed gradually over the interwar and war years was the shift in the hay acreage from grasses to the higher yielding legume hays, which have a higher protein content and therefore help to balance the livestock ration. Figure 21 shows the digestible protein available in hay per roughage-consuming animal unit, by 5-year periods since 1920. This chart summarizes the changes that have taken place.

It indicates that except for the drought years (included in the period 1930-34) the increase has been gradual throughout the entire period. The shift toward higher quality and higher yielding legume hays is likely to be accelerated in the postwar years as farmers begin to include more hay and pasture in their crop rotations. The higher protein content of the hay crop will help to balance the ration, and the increased yield of hay will offset at least part of the reduction in volume of production that otherwise would accompany a smaller acreage of intertilled crops.

Development of hybrid seed corn is easily the most important of the interwar and wartime improvements in varieties and strains of crops. Because corn normally occupies from 25 to 30 percent of the harvested cropland any improvement that greatly increases corn yields will naturally have a substantial influence on total production.

Commercial hybrid seed corn was first produced in Connecticut about 1922. Hybrids adapted to the Corn Belt became available in 1929. In 1933 a total of about 143,000 acres was planted with hybrid seed, and in 1945 about 60,347,000 acres. Figure 22 shows the percentage of the corn acreage planted to hybrids, by years since 1933, in the North Central States and in the United States. Adoption of hybrid seed has been especially rapid in the North Central States where adapted hybrids were available to farmers earlier, and where corn is the most important farm crop.

Experience with hybrid seed indicates that acre yields are increased about 20 percent over the yields of open-pollinated varieties. The percentage increase is usually about the same on good as on poor land, which tends to give additional advantage to higher yielding areas because expenses do not rise in proportion to the increase in yields.

Corn production in 1944 was nearly 40 percent above the average in 1935-39. The acreage harvested was 5 percent greater, and yields per acre were 32 percent higher. A part of this increase in yields can be attributed to better growing weather than in 1935-39, and a smaller part of it to increased use of fertilizer and improvement in cultural practices. But the most effective influence was the greater use of hybrid seed. Assuming an average increase in yields of 20 percent over open-pollinated corn, hybrid seed added 400 million bushels to the 1944 corn crop. Nearly 16 million more acres would have been required to grow that much corn if open-pollinated seed had been used.

The average corn crop for the years 1942-44 was more than 3 billion bushels (fig. 23), as was the 1945 crop, despite the handicap of delayed planting and unfavorable growing weather. Hybrid seed has shown remarkable resistance to unfavorable weather. It appears that 3-billion-bushel corn crops will become the rule rather than the exception in postwar years--even with some contraction of acreage to make room for more hay and pasture. A farmer must bear in mind of course that higher yields of corn remove more fertility from the soil, and that this necessitates using more commercial fertilizer, better crop rotations, more livestock, and better utilization of farm manures if yields are to be maintained.

Annual production of sorghums for grain in the years 1942-44 was 235 percent of the prewar years 1935-39. The grain sorghums are grown largely in the Great Plains States where the yields vary over a wide range, depending upon weather. Figure 24 indicates that both acreage and production have increased within recent years. Relatively favorable weather, development of new high-yielding varieties that can be harvested with a combine, and the high wartime prices for feed grains, have all contributed to the increased production of grain sorghums. A larger acreage of winter wheat and low abandonment held down the acreage of grain sorghums in 1945. Less favorable growing weather reduced the yield to 15.1 bushels compared with an average of 17.2 bushels in the years 1940 to 1944.

New varieties of oats have now been introduced that result in increases comparable to those of hybrid corn in yields per acre. But the effect on the total production of oats has not been so noticeable because the improved varieties have not yet been used over as extensive areas. However, better winter varieties adapted for the South have helped to expand acreage and to obtain higher yields in that region. New varieties--such as Tama, Boone, Vicland, and Marion--adapted to the Northern States, have been grown on a wider scale recently, and now the Clinton variety is proving superior to these in some areas. With wider adoption of improved varieties, oats may have a stimulation to yield, in the late 1940's, similar to that which was given to corn in the late 1930's and early 1940's.

Wheat production averaged more than one-fourth higher in 1942-44 than in 1935-39, with a planted acreage only four-fifths as large. More favorable growing weather than in those earlier years is of course the outstanding reason. Figure 25 indicates that a considerable part of the increase in yields, during the war, is represented by recovery from the drought levels of the 1930's. This is especially evident in the hard-

winter and spring-wheat States, which had more than 70 percent of the planted acreage in 1940-44. There also appears to have been an upward trend in yields in the last decade or so that was badly obscured by the drought cycle. It seems reasonable to expect yields higher, by about 2 bushels per planted acre, in the next few years, than the long-time prewar average. Back of this increase are improved varieties, soil and moisture-conserving practices, and mechanization which increases the timeliness of operations.

Although both the acreage and the total production of cotton have been lower in the war years than in 1935-39 the yield per acre has continued the increase that seems to have begun in 1931. The yield receded somewhat in the drought years, but it reached a new peak in 1937, and an all-time record in 1944. Figure 26 shows the contrasting trends of cotton acreage and yield per acre. Both the acreage and the yield per acre in 1945 were below those of 1944. Weather was unfavorable, especially at planting time.

The continued increase in yields of cotton can be attributed largely to the following factors: (1) increased use of fertilizer, (2) a shift to higher yielding areas with reduction in acreage, (3) careful selection of land within each area and on individual farms, (4) use of improved varieties, and (5) increased use of legumes. These factors have not operated with equal effectiveness in all cotton-producing areas. The result has been a considerable shift in production between areas. This is brought out in figure 27, which indicates that the Irrigated, the Delta, and the High Plains areas have increased their production of cotton above their 1928-32 levels. In some other areas, as in the Texas Black Lands, production in 1944 was below 50 percent of 1928-32.

Other crop changes that have influenced the level of production materially are the increased yields per acre of white potatoes, the increase in both acreage and yields of fresh and processing vegetables, and the larger acreage and greater bearing surface of fruit trees.

Changes in yield per acre harvested of white potatoes in selected States and for the United States from 1919 to 1945, are shown in figure 28. The upward trend in yields is pronounced in nearly all the chief commercial States. The United States average shows a gradual upward climb; it was interrupted for several years in the early 1930's but reached new highs in the early 1940's. The 1945 yield of 150.6 bushels per acre harvested was the highest on record.

There are two principal reasons for the higher yields of potatoes. Adoption of a whole group of improved practices is one--raising higher yielding varieties, heavier fertilization, and more effective insect and disease control. The second reason is that these improvements, combined with mechanization, have pushed more of the production into the hands of specialized commercial growers who use the new methods on large acreages, in areas that are especially adapted to potatoes. This has brought a considerable change in the location of the production both within several of the chief producing States and among the different States. The harvested acreage of potatoes has gone generally upward since 1919, in California, Idaho, and Maine. On the other hand the acreage in the Lake States (Minnesota, Wisconsin, and Michigan) has had a downward trend.

Gradual concentration of potato production largely in the hands of specialized producers, who are located in the most favorable areas, is still under way, and is likely to continue for several years. If weather conditions are favorable, new yield records will be established as the large-scale, specialized producers make further improvements in their production methods.

Acreages devoted to commercial truck crops increased sharply in the period between the two wars (table 5). Improvement in techniques of production, better knowledge of disease and insect pest control, and improved methods of marketing and distribution gave producers added incentives on the production side. A better appreciation by consumers of the nutritional value of vegetables in the diet contributed to an expanding consumer demand and provided a market for a corresponding increase in production.

Acreages of fresh-market vegetables increased more rapidly than the acreages of vegetables for processing, during the interwar period. Production of processed vegetables increased rapidly after 1933, however, partly because of improvements in the freezing of foods and the resulting rapid expansion in demand for frozen vegetables.

Consumption of fresh vegetables, per capita, increased from an average of 205 pounds in the period 1920-27 to 235 pounds in the 5-year period 1935-39, and to 255 pounds in 1943. Consumption of canned vegetables was 19.6 pounds net canned weight per capita, in 1920-24, 30.4 pounds in 1935-39, and 36.8 pounds in 1943.

The upward trend in acreage of fresh-market vegetables in the interwar period was reversed, beginning about 1940. From 1940 to 1943

Table 5.- Harvested acreage of commercial truck crops for fresh market and for processing, United States, 5-year averages, 1920-44, and annual 1940-45

Year	For fresh market	For processing	Total
	Thousand acres	Thousand acres	Thousand acres
1920-44	739	741	1,480
1925-29	1,160	1,025	2,185
1930-34	1,600	1,064	2,664
1935-39	1,745	1,383	3,128
1940-44	1,706	1,773	3,479
1940	1,720	1,377	3,097
1941	1,695	1,641	3,336
1942	1,662	1,968	3,630
1943	1,573	1,926	3,499
1944	1,880	1,951	3,831
1945 1/	1,901	1,913	3,814

there was a definite downward movement. This was influenced in part by the difficulties that growers had in obtaining farm labor and production supplies, by more emphasis on other needed commodities, by a shift from fresh to processing vegetables by many growers, and by the victory gardens that displaced some of the commercial market.

The relatively small acreage in 1943 resulted in very high prices to growers, and consequently in high returns per acre. Expansion of acreage the following year was thus stimulated; and 1944 had the highest acreage of fresh-market vegetables that had ever been harvested, but even that acreage was exceeded in 1945.

In contrast to the downward trend of fresh-market vegetables during the first 3 war years, the acreage of vegetables for processing increased sharply over the previous year in 1941, and again in 1942. It

1/ Preliminary estimate.

was maintained in 1943, 1944, and 1945 at about the 1942 level, or about 40 percent above the 1935-39 average. Heavy wartime demands for processed foods for military and lend-lease use provided the basis for this expansion. The major processing vegetables were supported at prices favorable to the growers and this encouraged grower interest in meeting the requests for greater production.

The demand for canned vegetables may drop considerably after the requirements for war and relief work have subsided. But there is every reason to anticipate an expanding outlet for frozen vegetables which may more than compensate for any decline in the quantity of processing vegetables that go into cans. The peacetime outlook for all vegetables will be closely related to the level of consumer purchasing power.

With the exception of citrus fruits the wartime changes in fruits came primarily in the utilization of the crop rather than in the volume of production. Bearing acreage of tree fruits is not susceptible to much change within a few years, so that higher demand is reflected mainly in higher prices rather than in increased output. Most commercial acreage must be well cared for at all times, and orchards that are allowed to deteriorate through lack of care usually cannot be restored. More fertilizer and better cultural practices will bring increased yields in many orchards, but the shortage of labor and supplies during the war years largely prevented using these means to increase the output. Changes that occurred during the war therefore were usually continuations of trends that were in evidence during interwar years. Strawberries and cranberries are the only important fruit crops in which acreage and production were materially affected by the war. Acreage of these two crops combined declined from 205,000 in 1941 to 117,000 in 1944. Decline in production was even more marked.

Acreage of deciduous fruit trees of bearing age reached its highest level in the late 1920's and early 1930's. During the last decade the acreages of most of the deciduous fruit trees have declined gradually but citrus trees have increased. Total production of combined fruits has increased; this is attributed almost entirely to the rapid increase in the production of citrus fruits. Fruits other than citrus have remained at a relatively constant production level during the past 15 years (fig. 29).

The striking point in the fruit picture is therefore the change that occurred in citrus production. From a relatively unimportant part, citrus fruits have increased until they constitute almost one-half of

total fruit production on a tonnage basis. Citrus production increased from about 2 million tons in 1929 to 7.1 million tons in 1943--a three-fold increase in 15 years. The trend is still sharply upward. As most of the orange and grapefruit trees have not yet reached full production, with present numbers of trees and with normal care of orchards, production and yields can be expected to keep on rising through several decades for the trees are relatively young.

Yields of all fruits on a bearing-acreage basis have increased within 15 years. The increasing average age of the trees probably has been the most influential single cause. This holds true even for apples, although little further increase in yields of apples can be expected because of the increasing age of trees.

A shift to fruit production usually means that a product of higher value per acre is obtained as soon as the orchard is of bearing age and the output increases as the orchard grows toward maturity. These factors partly account for the large increases in gross farm production over a period of years in Florida and in the Pacific States.

A continuation of wartime prices for fruit into the peacetime period undoubtedly would encourage many new plantings of fruit trees, although growers generally hesitate to embark on an expansion program that is based upon present high prices since the effect of new plantings on production will not become apparent until a decade or more in the future. Because many fruits are still considered to be virtually a luxury food by many consumers, the level of national income after the war will be even more important to growers of fruits than to producers of other agricultural commodities.

Changes in Livestock Production

Three major forces are back of the changes in livestock production in the interwar and war years. They are: (1) the shift from animal to mechanical power, (2) the variations in the total feed supply, and (3) the increased production per animal.

The decrease in horses and mules of 15 million animal units from 1920 to 1945 released land that could grow feed for an equivalent number of productive livestock (animals and their products that are produced for human use). The saving in grain alone amounted to about 13 million tons in 1944--enough to feed 26 million hogs to market weight.

Year-to-year changes in the total feed supply have been about as important in their effects on livestock production for human use as the shift to mechanical power. The severe drought years, 1934 and 1936, reduced total feed production (feed grains, hay, and pasture) about 30 and 25 percent respectively below the 1928-32 average. On the other hand, total feed production in the war years 1942-44 averaged about 20 percent above the 1928-32 levels, and 25 percent higher than those for 1935-39. Current feed production in the years 1942-44 increased about in proportion to the increase in livestock. Total livestock production was about 25 percent above 1935-39 in the years 1942-44, but the volume of productive livestock (excluding horses and mules) was one-third higher.

In addition to the changes in the supply of feed there have been important changes in quality, resulting in the feeding of rations that are more balanced with respect to protein and other nutritive elements. The gradual increase in the protein content of the hay supply has been mentioned (fig. 21). The greater supply per animal unit of oilseed meals and other high-protein feeds during the war also helped to balance the feeding rations and to push livestock production upward.

Changes that have taken place since 1919 in production per unit of breeding livestock are shown for all cattle, and for hogs and poultry, in figure 30. Figure 5 showed changes in the total production of livestock for human use per animal unit of breeding livestock. These series of production per animal unit of breeding livestock are similar to series that show changes in yields per acre of different crops and production per acre of all crops. They measure the combined effects of all the forces that are back of the changes in livestock production per unit of breeding stock. Similarly, the indexes of crop yields per acre, or an index of production of all crops per acre, measure the combined effects of all the forces that operate to change crop yields, or the total crop production per acre.

Changes in livestock production per animal unit of breeding livestock are influenced by weather, chiefly because feed supplies are affected by favorable or unfavorable growing conditions. The bad drought years of the 1930's are reflected in reduced production per unit of breeding animals for all three classes of livestock. But the downward trends shown for those years in figure 30 probably also reflect less attention to livestock in other ways because of the depression and the low prices. On the other hand, the years that combine large feed supplies and favorable prices for livestock soon show the increased production that results both from more liberal feeding and from better care in other ways. For example, in cattle production a larger calf crop, reduction in death loss, and prevention of disease all combine with better feeding and other care to produce more meat and milk per cow in the breeding herd.

One measure of increased efficiency in livestock production is the increase in output per unit of feed. There is evidence that significant gains have been made in this direction in all classes of livestock but the data available on a national basis are not sufficiently refined to trace these changes. Information obtained in the Corn Belt over a period of years on feed consumed by hogs indicates a reduction of 10 to 15 percent in the quantity of feed used per 100 pounds of pork from the decade of the 1920's to the decade of the 1930's. 5/ The number of pigs saved, the prevention of disease, the improvement of breeds, and the feeding of balanced rations all tend toward increased efficiency in the use of feed.

If similar data were available for tracing changes in feed consumed per 100 eggs produced it seems likely that even greater reductions in feed per unit of product would be shown. Even the over-all national estimates indicate a reduction of about 12 percent in concentrates consumed per 100 eggs produced from the period 1920-24 to 1937-41. 6/

The sharp rise in poultry production per unit of breeding stock reflects in part the large shift to broiler production that has developed. However, figure 31 shows the trend of egg production per layer for the average number of layers on farms, and this series on egg production also shows a sharp upward climb, especially within late years.

The trends in poultry and egg production reflect the noteworthy improvements that have been made in the poultry enterprise. In many parts of the country, and especially in the Midwest, it has been transformed from a sideline to an important phase of the farm business.

Figure 32 shows the changes in milk production per cow over a period of years. There was a sharp increase in the 1920's, and then a drop from 1929 to 1934, reflecting the drought and depression conditions then prevailing. Larger numbers of cows were milked in the depression years than in the 1920's. As a result, a larger proportion of the cows milked were of beef or mixed breeding. And the feed supply was reduced by drastic drought. Milk production per cow did not return to 1929 levels until 1938. It was maintained at high levels during the war and reached an all-time peak of 4,789 pounds per cow in 1945.

5/ "Feed Consumption and Marketing Weight of Hogs," by L. Jay Atkinson and John W. Klein. U. S. Department of Agriculture Tech. Bul. No. 894, 1945, pp. 19-21.

6/ "Feed Consumption by Livestock, 1910-41," by R. D. Jennings. U. S. Department of Agriculture Cir. No. 670, 1943, p. 28.

That production per cow seems high in relation to previous years but there is still room for considerable improvement. The average milk production per cow, for cows on which full-year records were kept by Dairy Herd Improvement Associations in 1942, was 8,366 pounds compared with a national average of 4,738 pounds in that year. In other words, the cows in Dairy Herd Improvement Associations produced about 75 percent more milk per cow than the national average. These two estimates of production per cow are not strictly comparable, but the difference between the two figures does indicate the potentialities of greater production per animal.

More feed per cow, and better balanced rations, would be the two most influential factors in achieving a higher national average production per cow. Because such a large proportion of the feed used by a dairy cow is required for maintenance, underfeeding means that most of the feed is used for body maintenance, and a relatively small part of it for milk production. In the newer dairy areas, and where dairy production is only a sideline, underfeeding is rather common.

It is recognized, of course, that there are economic limits to increased feeding and that these are reached before the physical limits are approached. The economic limits will vary with the price of the product in relation to the cost of feed, and in relation to other expenses. This is true in all classes of livestock. But many farmers feed their cows at levels far below the economic limits, even when milk is high in price in relation to feed. On the majority of farms to increase the feed supply per animal, for dairy cows as well as for other classes of livestock, would increase both output per head and net income to farmers.

Other factors also will tend to increase production per animal in the years ahead. In dairy cattle, artificial insemination makes it possible to develop the higher milk-producing strains more rapidly than in previous years. On many farms the herd bull will disappear, and the feed that was formerly consumed by the bull will be fed to milk cows. More progress will be made in control of disease for all classes of livestock. Improvements in hog breeding are already under way that will increase efficiency in use of feed and produce a higher quality carcass.

More progress is called for in improving shelter and equipment, in order to reduce labor and capital requirements in caring for livestock. Further improvements in the quantity and quality of the feed supply and in reducing the cost of making the feed available to livestock are badly needed. As farmers shift toward more soil-conserving systems of farming, more hay and pasture will be available, and that

means more roughage-consuming livestock. But improved techniques are needed to produce the roughage in ways that will result in more livestock and livestock products at lower cost per unit of product.

As the introduction of mechanical power gradually makes further progress in the South, the numbers of productive livestock are likely to increase, because of the feed that will be released and because systems of farming are likely to be developed that include more hay, grain, and pasture--crops that can be handled by mechanical equipment. Cattle numbers have increased relatively more in the humid areas of the country than on the ranges of late, because of the shift to tractor power. This proportionately greater increase is likely to continue. On the ranges expansion of livestock production is dependent upon improvements that will increase carrying capacity, and upon developments that will make it possible to produce more winter feed.

Incentives for Increased Production

That farm production in the 1930's was held in check by drought and depression, despite the technical progress in mechanization and in other lines, has been emphasized. War needs and the incentive of higher incomes broke this dam and released a flood of increased production. But this was not accomplished by one blast at the beginning of the war. It was a fairly gradual process. Both farmers and agricultural workers were too conditioned by the experience with surpluses to believe that the market really would absorb all that the agricultural plant might produce under stimulation. This skepticism was supported by the sag in the prices of some products during the year that followed the outbreak of the war in Europe.

But gradually the war demands emerged, and with the passage of the Lend-Lease Act on March 11, 1941 they gathered a momentum that remained unslackened for the duration of the war.

The first public pronouncement of the need for increasing the production of food was made by the Secretary of Agriculture on December 26, 1940, when he urged the desirability of breeding more sows for spring farrow in 1941. On April 3, 1941, price supports were announced for dairy products, hogs, chickens, and eggs, that would be effective until June 30, 1943. This announcement assured farmers of a market for an increased production of these products. But production controls were maintained on wheat, cotton, tobacco, and corn for the years 1941 and 1942. They were removed from corn in January 1943, from wheat in February 1943, and from cotton in July 1943.

Part of the reason for maintaining production controls in the early war years was to obtain a shift in the direction of meat, eggs, milk, and oil crops--the products most urgently needed in the first part of the war. But a more effective means was needed for achieving the most desirable combination of farm products. The program of formulating and announcing production goals, combined with support prices and with production payments geared to the relative urgency of need for different products, was developed to serve this need.

The first production-goals program was worked out in the summer and fall of 1941. It outlined the food needs for 1942 and stated the production objective for each product. These goals were revised in January 1942, following the attack on Pearl Harbor. Goals were successively developed for each of the succeeding war years.

Production goals were one step in the process of arriving at a balanced production program. Before goals were determined for any product the prospective needs were analyzed in relation to the resources and the facilities available for its production. Then each product was considered in relation to all the other farm products that were needed in a balanced production program. Studies of production capacity for individual products, and for all products combined into a production program geared to prospective needs, were made in each State to provide a production guide for the goals program. The production-goals program as finally developed pointed the direction and indicated the distance that should be traveled to achieve a balanced production.

Support prices and production payments, when balanced in relation to the desired production of each product, furnished most of the driving force that was needed to achieve the objectives outlined in the goals program. But education and information concerning war needs also played an active part, and patriotism helped as the war progressed. Many farmers grew soybeans, peanuts, flax, dry beans, and other strategic war crops because they felt the need was urgent, even though they might have obtained somewhat larger returns by growing other products.

So far as possible, however, support prices and production payments were intended to make the most urgently needed products the most profitable to the producers. Efforts in this direction were somewhat limited by the minimum loan provisions for some crops, and by price ceilings on others; but in general a pattern of support prices and payments was eventually achieved that was reasonably well balanced in relation to the war needs for each product.

With production goals to point the direction and to indicate the distance to be traveled; with support prices, production payments, and

educational persuasion; with patriotism and family participation in the war as the fighting continued, as incentives to attainment, a level and pattern of production was finally achieved that was fairly well proportioned to war needs. Some of the demands for food were not satisfied. They could have been met only by devoting more labor, equipment, and materials to agriculture at the expense of other sectors of the war program. But the most urgent needs were satisfied, and the pattern of production was shifted in the direction of products with the highest war priorities. It seems doubtful that the large changes in production which were shown in figure 2 could have been accomplished without a program that emphasized the need for those changes, and that supplied incentives for obtaining them. Greater shifts from livestock products to direct food crops could have been made if the food requirements that were developed had called for more sacrifice in quality in order to provide food for more people. And if the need had been so urgent as to have forced a larger allocation of resources to agriculture it would have been possible to obtain much greater increases in production.

So far as materials were concerned, farmers felt the greatest pinch in new farm machinery, especially for the production year 1943, when only 23 percent of the 1940 volume of steel used for farm machines was originally allocated for that purpose. This allocation was increased later, but new machinery was unobtainable for most farmers in 1943. More farm machinery could have been substituted for labor, and the process of mechanization would have been more nearly complete at the end of the war. This in turn would have facilitated agriculture's adjustment to peacetime conditions.

Shortages of some other materials developed early in the war. Fencing, building materials, containers, and other items were scarce; but the minimum needs were met by careful distribution of available supplies. Fortunately, the supply of insecticides and of commercial fertilizer was fairly ample, although more would have been used if it had been available.

Scarcity of labor constituted the worst obstacle to production in some of the seasonal cash-crop areas. The Office of Labor and the State Extension Services assisted in bringing in outside labor, and in recruiting and training local labor from previously untapped sources. Farmers and their families worked long hours, and somehow the essential jobs were done.

Figure 33 summarizes in terms of gross and net farm income the results to the Nation's farmers of the incentives to production and the actual achievement of their war job. The realized net income for the years 1942-44 was 243 percent of the 1935-39 average; in 1945 it was 277 percent of the average for those years.

The operator's net farm-income experience on typical family-operated farms for different types and locations is shown in figure 34. This chart traces the extremely low net incomes that prevailed during the drought and depression of the early 1930's, the slow recovery during the late 1930's, and the rapid rise in the war period. The high net income during the war is only partly accounted for by the fact that prices received for farm products doubled, and rose much faster than did the prices paid by farmers. The greatly increased production per farm meant relatively lower expenses per unit of product; and with more products to sell, the net incomes rose much faster than the increase in prices for those products. In other words, a higher output per farm and per worker means relatively lower costs per unit and higher net incomes per farm and per worker, even if there is no rise in farm prices.

PEACETIME IMPLICATIONS OF INTERWAR AND WARTIME CHANGES

The forces that shaped the course of agricultural production in the interwar and war years have been analyzed briefly in these pages. Their effects on production are evident in the record-breaking volume during the war. Most of these forces still have unexpended power. And they will continue to influence production in the years beyond the immediate transition from war to peace. New forces will be injected. Some of them are already on the horizon. Others cannot be foreseen, but they should be expected. And farmers will need to adapt their operations to the rapidly changing conditions.

Prospective Peacetime Changes

Looking forward beyond the first transition years to the time when farming will be adjusted to peacetime conditions, some changes seem fairly certain. They will result from the continued operation of the forces now under way, and from those that are on the horizon. The changes that seem most likely to occur are summarized as follows.

1. A continued increase in the adoption of mechanical power until it has largely supplanted animal power is to be expected. The number of tractors on farms in 1950 is likely to be at least 2,600,000. If purchases are accelerated in the South, and in some other areas, by the introduction of smaller tractors that are more suitable for small farms and rolling land, there might be as many as 3,000,000 tractors on farms by 1950.

2. Further adaptation of machines for use with mechanical power is certain. Each phase of agricultural production will become more mechanized, and more fully adapted to mechanical-power techniques. Eventually the same type of stability may be achieved with mechanical power

as was attained with machinery adapted for animal power, previous to World War I. But this process will require some time for full development.

Haying equipment will be adapted to the special conditions of each producing area. Mechanical cotton pickers will be adopted, gradually at first, and then more rapidly as changes are made for more effective use in areas of rolling land and small farms. Some progress may be expected in mechanizing such traditionally hand-labor crops as sweetpotatoes, and even tobacco.

3. Use of lime and commercial fertilizer will increase above the high wartime levels. How rapidly this increase will come depends partly on the kind of educational and conservation programs that are developed, and partly on the level of farm incomes. But many farmers have learned for the first time in the war years the value of lime and fertilizer, and they are not likely to reduce their purchases except under conditions of severe depression.

4. Along with the use of more lime and fertilizers will come more rapid adoption of other conservation practices, such as using winter cover crops, grass and legume crops in the rotation, contour farming, strip cropping and other practices designed for erosion control.

5. Further progress will be made in varietal improvements. For example, Lincoln soybeans and Clinton oats are now being introduced. Suitable corn hybrids are being developed and will be adopted in the Southern States. The effects of improved varieties of grain sorghums will become more pronounced.

6. More efficient methods to control pests and diseases will be available for both plants and animals. War has developed new and effective materials and improved techniques for applications.

7. Results from animal-breeding experiments will gradually increase the efficiency of livestock production. Work now under way is likely to produce hogs that are more efficient converters of feed into pork of the more desirable cuts. Dairy-herd improvement will be accelerated by more widespread use of artificial insemination.

8. Further improvements will be made in feeding methods. More adequate and better balanced rations will contribute to increased output per animal.

9. Some new land will be brought into cultivation by irrigation, drainage, and clearing. But the total acreage of new land is not likely to be very large--perhaps 3 to 5 million acres in the next 5 years, and then further additions as projects now being planned are completed.

10. Some land will be abandoned in the poorer land areas. If opportunities for employment are freely open in the cities, many small and unproductive farms will shift from full-time to part-time operation, and even to rural homes on which little or no farming is done. If depression conditions should prevail for any length of time this movement might be reversed, as many unemployed people are likely to try to make at least a part of their living from the land.

Effect of Prospective Changes on Farm Output

Prospective changes that have been outlined are preponderantly those that will tend to push the output of farm products for human use higher and higher, instead of allowing them to recede toward the prewar levels. In their recent study of peacetime production adjustments, State Committees estimated that under favorable economic conditions it would pay farmers to produce products for human use by about 1950 at a level 11 percent above 1944. 7/ These estimates gave consideration to maintenance of soil resources and included the effects of the adoption of known improvements that would be profitable under conditions of prosperity.

But more effective educational and other programs would be needed to accelerate the adoption of improved practices that would be necessary for such an increase to occur by about 1950. The output for human use may therefore increase more slowly than this estimate indicates would be profitable, even under favorable conditions; unless some new accelerating force is introduced. If economic adversity should prevail, the rate of increase in output would be slowed down, but even under unfavorable price conditions, it seems unlikely that the total output for human use would be reduced substantially unless weather conditions were below average. Any reduction that would result from the use of less fertilizer, or from other attempts to reduce variable costs, would probably be offset by the effects of the landward pressure of unemployed people.

7/ "Peacetime Adjustments in Farming--Possibilities Under Prosperity Conditions." U. S. Department of Agriculture Misc. Pub. No. 595, 1945.

Severe drought, or other unfavorable growing conditions, could reduce the level of output considerably. In a drought year, like 1934 or 1936, the output might drop about 20 percent. But it would increase again when growing conditions improved. Some of the improved practices, such as using hybrid seed corn, drought-resistant varieties of wheat and grain sorghum, summer fallowing and contour farming, provide considerable protection against unfavorable weather. But on the other hand, the yield-increasing effects of fertilizer and some other practices would not be realized in case of severe drought. Crop loss from unfavorable weather is one of the major hazards in present-day commercial farming. The crop-insurance programs of recent years were developed to provide protection against such losses, but so far insurance is available only on certain crops, and many farmers who operate in the most hazardous areas are not participating in the program.

Aside from the hazard of unfavorable weather, most of the changes that have already taken place, as well as those in prospect for the years ahead, seem to point irreversibly in the direction of increased production. For the immediate transition period there is urgent need for all the food that can be produced. Food will help to restore the peace of the world. But when the transition from war and relief needs to peacetime market outlets has been completed, food production at high levels may have to face market difficulties, unless high employment and purchasing power are maintained, and the channels of international trade are kept open.

But regardless of the market outlook, there is no road back from the agricultural revolution that has been experienced during the inter-war period and World War II. Attention therefore necessarily centers on mobilization for efficient and profitable peacetime agriculture instead of reconversion to a prewar situation that will never return.

If the belief still lingers that production will recede to prewar levels, under average weather conditions, the steps that would be retraced should be considered. Farmers generally cannot go back to animal power. There are too few horses and mules now on farms. The annual colt crops do not begin to maintain even present numbers. The mechanical-power phase of mechanization is here to stay, and it is the cornerstone of high-volume output for the market. Going back to open-pollinated corn, or to low-yielding strains of other crops would be decidedly unprofitable even under depression conditions. And more effective control of insect pests and diseases is likely to be continued somewhat regardless of price conditions.

It is possible that less fertilizer and lime would be used under depression conditions, of course, although it would be poor economy to reduce yields in this way. And it would be contrary to the national interest to fail to apply the fertilizer that is necessary for maintaining stable, soil-saving crop rotations. Similarly, temporary reductions in expenses could be made by not carrying out certain conservation practices, but these savings would be made at the expense of future productivity.

The only effective steps that can be taken to reduce the total volume of output are those that shift either capital, or land, or labor resources out of agriculture, or perhaps shift all three. But the preceding discussion indicates that if farming is to be carried on at all, an adequate supply of capital is needed for equipment and for current operations in order to achieve the most effective combination with the land and labor resources that are used in farming at any given time. In fact, many individual farmers have a tendency to invest too little capital with their land and labor resources; and changes in types of farming require new capital investment. This means that the primary steps in reducing the total volume of farm output would have to be taken by shifting either land or labor to other uses.

It is possible of course to use the agricultural land and the labor resources less intensively and to reduce output in that way. Land can be shifted from intertilled crops to lower yielding sod crops, and some lands now in crops can be returned to grazing. Such shifts would reduce output, but farmers tend to resist these changes for the reasons noted later.

Farm work days could be shortened. This would mean that less work would be done per worker. Farmers undoubtedly will slacken the pace they maintained in wartime and it is highly desirable that they do so. But more workers will be available on farms and besides, with further mechanization, the job can be done without working so hard. Consequently the effect on production of a shift to shorter working hours may be more than offset by more workers and more mechanization. In fact, the substitution of mechanical power for animal power increases the labor effectiveness of the farm family so much that pressure usually develops to rent or buy additional land. If more land cannot be obtained an attempt is often made to use the land now farmed more intensively. For example, soybeans can be substituted for oats, dairy cattle for beef cattle, and the side-line poultry flock can be expanded to an important enterprise in the farm business.

This tendency toward increased production per farm as a result of mechanization usually operates in the direction of more intensive rather

than less intensive use of land resources. Therefore, if land is to be shifted from intertilled crops to sod crops, or from cropland to grazing, farmers must be convinced of the profitableness to them of this shift over a period of years. Otherwise public compensation is necessary to bring about such adjustments.

Some of the unproductive lands could be shifted out of arable farming by Government purchase or lease. They could be devoted to grazing or to forestry and recreational uses. Programs of this kind are needed in "fringe areas" of land that are poorly suited for agricultural production. But the total volume of output for human use would be affected only slightly by carrying out such a program in poor-land areas. And public opinion probably would not support a program that would hold productive cropland out of arable farming for any considerable length of time.

It appears that about the only effective means by which the volume of output could be reduced is by a shift of workers from farming to other occupations. That would occur only if employment off the farms were available for those who could not find attractive opportunities in agriculture. This question is discussed later, but it should be noted here that the shift would have to be large enough to result in a net decrease in the number of workers engaged in agriculture. A migration from farms of this magnitude would be quite unlikely under depression conditions. In fact, there was a net landward movement in the early 1930's.

The conclusion seems inescapable that no forces are now operating, or are likely to appear, that are sufficiently strong to offset much of the effect of the forces that will push agriculture in the direction of high-level production. Individual crop or livestock enterprises could be reduced in volume, either by voluntary shifting to other products or by production-control programs; but other products would be substituted and so total output would not necessarily be affected. To reduce the total volume of farm output without shifting land and labor resources to nonfarm uses would require rigid controls. It would mean strict rationing of the use of land and labor in farm production.

Output in Relation to Potential Markets

If the output of farm products for human use is likely to remain high in the years ahead, it becomes necessary to examine the prospective volume in relation to potential markets. As a basis for striking a balance between potential output and potential markets it seems desirable to summarize the main forces back of increased production into two groups.

One is the shift from animal to mechanical power. The other is increased production per acre and per animal. Some new land will be developed by clearing and draining, and by irrigating arid lands; but this is likely to be a minor rather than a major factor in increased production. Irrigation of land now in arable farming would come under the heading of increased production per acre.

It appears that the shift to mechanical power will proceed at a rapid pace for several years. But its effect on total output will diminish progressively as horse and mule numbers decline toward minimum levels. This means that increased output will then come mainly from increased production per acre and per animal. The rate of such expansion is dependent upon new advances in technology, and their adoption by farmers.

It seems probable therefore that the rate of increase in production might slow down after the substitution of mechanical power has spent its force. Even the rate of increase for the years immediately ahead is not likely to be at the wartime pace, because part of that increase represented release of production capacity that had been dammed up by drought and depression. But previous discussion indicates that an upward trend should be expected.

On the market side the largest item is the level of domestic consumption of farm products. This depends on the size of the population, and on the purchasing power that is available for consumers to buy farm products. The population of Continental United States is still increasing, even though the rate of increase is slower than in former years. One is likely to forget that there were nearly 20 million more people in this country on January 1, 1946 than on January 1, 1929, and about 10 million more than in 1939. By 1950, the population is likely to be about 15 million larger than in 1939.

Figure 35 shows farm output per capita and cropland per capita by years from 1919 to 1944. Although the cropland per capita declined about 23 percent in that period the level of farm output per capita increased about 15 percent. Assuming average weather conditions, the 1942-44 level of output per capita probably would average about 10 percent higher than in the 1920's.

If exports could be maintained at the same levels as in the 1920's, and if output increased only at the same rate as the population increased, the per capita domestic consumption of farm products would need to be stepped up about 10 percent above the level of the 1920's to absorb the

total farm output. An expansion of domestic consumption of this magnitude would be quite possible of achievement if full employment and high purchasing power were maintained, and if other measures were taken to achieve more adequate consumption of farm products. In the 1920's a large segment of the population did not have the money to buy food enough for minimum adequacy. Consumption of nonfood farm products also was restricted by the low incomes of some groups. And the export market, although greater than in the 1930's, was not so large an outlet for farm products as it would be possible to develop in an expanding peacetime world economy.

Another approach to estimating the farm output that might find market outlets can be made by taking as a starting point the quantity of farm products that historical evidence indicates consumers would buy under prosperity conditions, and then adjusting those quantities for nutritional adequacy. The result might be called potential consumption, assuming a high-level prosperity diet. To this estimate of domestic food consumption should be added an estimate of the nonfood farm products that would be likely to be used under prosperity conditions; and an estimate of potential exports that would be consistent with a high level of prosperity and a fairly large volume of international trade.

A measure of potential market outlets by 1950, computed in this way, can be compared with the estimate of potential output under prosperity conditions that was made by State Production Adjustment Committees in 1944 (see page45). Table 6 gives such a summary comparison of potential output and market outlets by 1950, under defined economic conditions. It should be emphasized that this comparison is not a forecast of what will happen even under conditions of prosperity. It merely illustrates potentialities. But it does indicate that if the high level of farm output that was estimated as profitable under favorable conditions were properly balanced it could find a market. Part of that market would have to be developed through programs of consumer education, and other programs that would make it possible for all groups to buy food enough for minimum adequacy. Net incomes to farmers would be satisfactory if high levels of economic activity and purchasing power could be maintained in the nonfarm sectors, and if programs of market development were undertaken.

Potential trouble spots on the farm front are pointed out in table 6--cotton, wheat, oil crops, potatoes, and eggs. The table indicates the need for shifts in production to balance prospective market outlets. Livestock, and livestock products other than eggs, are fairly well in

Table 6.- Illustrative comparison of potential output with potential market outlets by 1950, under conditions of economic prosperity

Commodity	Unit	Output in 1942-44	Potential output 1950 1/	Potential outlet 2/ 1950	Percentage potential output is of potential outlet
					Percent
Food grains 3/	1,000 tons	31,416	29,764	22,008	135
Feed grains	do.	118,784	126,867	111,520	114
All tame hay	do.	87,842	121,969	111,000	110
Beans and peas (uncleaned)	1,000 bags (100 lbs.)	27,745	23,686	19,400	122
Vegetables (fresh & processing)	1,000 tons	12,692	24,514	28,130	87
Potatoes and sweetpotatoes	do.	14,113	18,787	12,850	146
Soybeans	1,000 bu.	190,229	156,826	160,000	98
Flaxseed	do.	38,711	28,362	4/ 30,000	95
Peanuts	Mil. lb.	2,169	2,390	1,800	133
Cotton	1,000 bales	12,158	14,938	13,000	115
Tobacco	Mil. lb.	1,590	2,064	2,150	96
All citrus (fresh equiv.)	do.	13,729	15,200	14,900	102
All other (" ")	do.	17,768	20,350	20,100	101
Meat animals (liveweight slaughter)					
Hogs	do.	22,435	21,631	20,400	106
Cattle and calves	do.	18,557	20,388	19,300	106
Sheep and lambs	do.	2,148	2,240	2,160	104
Poultry (including broilers and turkeys)	do.	4,192	4,633	4,590	101
Milk production on farms	do.	118,777	148,173	145,000	102
Egg " " "	Mil. doz.	4,457	5,026	4,350	116

1/ From "Peacetime Adjustments in Farming--Possibilities under Prosperity Conditions"; but fruit production was not included in that study and it has been estimated from other sources.

2/ BAE estimates of market demand under defined economic conditions, adjusted to provide for nutritional adequacy.

3/ For food uses only.

4/ From domestic production.

balance. The hay and feed grains that are indicated as potential output would be somewhat more than ample for the accompanying livestock production, but it is possible that the estimated yields per acre for feed crops are somewhat higher than actually would be obtained with the educational and other programs that would be undertaken, and that even the part of the wheat production that would not find a market as a food grain could be shifted to feed uses if suitable pricing policies were formulated.

The suggested shift from less intertilled crops toward more hay and pasture, more meat and milk, and more fruits and vegetables, would provide an ample basis for high-level nutrition. It would also be an important step toward maintenance and improvement of soil resources.

These changes would tend to utilize more effectively the Nation's resources in both land and labor. Beef production is a land-consuming enterprise, and milk, fruits, and vegetables are labor-consuming enterprises. But changes in these directions are dependent upon a farm price-and-income structure that would make them profitable to farmers. Under conditions of prosperity these adjustments could be made profitable because consumers would have the purchasing power to buy high-value foods. But if depression conditions should prevail it would be very difficult to shift production in this way.

Adjusting Market Outlets to Balanced Farm Output

This rough balancing of potential production with potential market outlets indicates that the markets could absorb the potential production if conditions were favorable for high-level consumption. But market-development work would need to be undertaken at home. Export channels would need to be kept open. And shifts in production would be needed--in the direction of foods that would be emphasized in a high-level prosperity diet, and toward farm products that would find increased industrial uses, or that could be exported in larger volume.

As markets for farm products can be expanded, and as the total volume of farm output cannot be reduced without rigid rationing of land and labor it appears that the slogan "Adjust production to market demands" of the interwar years might well be reversed. It was applicable to shifts from commodities that were pressing heavily on market outlets and into the production of others that had a brighter market outlook. But when reduced purchasing power limited the outlets for all farm commodities the real remedy was not to be found in reduced production. If farm workers could have obtained other employment the balance might have been restored by reducing the total output of farm products, but the contracted purchasing power coincided with unemployment in the cities. And this caused

important, however, is the indirect effect of international trade in nonfarm products. Exports of automobiles and farm machinery, for example, create domestic employment and therefore increase the purchasing power for food and fiber.

A large volume of exports requires the acceptance of goods and services in exchange. Programs that would protect specific farm products at the sacrifice of greatly expanded world trade would create added competition in the domestic market on the part of farmers whose export markets had been destroyed by the trade restrictions.

Emphasis can be shifted in the direction of reducing costs or of developing more profitable alternatives for the products that would be injured by freer trade. If by mechanization and increased yields the cost of producing oil crops can be reduced materially, for example, they can be grown profitably and in large volume in competition with imported oils. If cost-reducing measures are not sufficient to achieve this possibility more profitable alternative enterprises need to be developed to replace the higher-cost portion of the production of domestic oil. Farmers can then shift to those alternatives. Such measures would enable farmers of this country to produce on a low-cost basis in competition with other areas, and to take and to hold the lead in productive efficiency.

Profitable and Abundant Farm Production

Farmers want to produce both abundantly and profitably. They want to make full economic use of their resources. The nature of farm costs makes abundant production the most profitable use of their resources by individual farmers. But the resulting large output under certain circumstances might lower the prices of some products so much that production would become unprofitable for the entire group of producers.

Individual wheat producers, for example, cannot reduce output without lowering their individual net incomes, but the price-depressing effect of a large crop may reduce the income to all wheat farmers. The case is usually not so clear-cut as this, but it is natural to reach the conclusion that wheat farmers would increase their incomes if they all reduced production by some pro rata amount. At this point, however, the wheat farmer's cost structure needs to be examined. If through mechanization he already has labor and equipment on his farm that is partly unutilized, a restriction of output means that his overhead costs will have to be carried by a smaller quantity of wheat. Therefore, his average costs per unit of product will increase if production is reduced.

For instance, in the spring-wheat area of northwestern North Dakota and northeastern Montana, a farm family using tractor power and appropriate tillage, seeding, and harvesting equipment can easily handle 800 acres of cropland in an alternate wheat-fallow rotation. This size of farm represents about a minimum from the standpoint of operating efficiency. With an allowance of $1,000 cash income for the operator's labor and management, and a return on investment at prevailing rates, the average cost per bushel of wheat sold on a farm of this size was about 78 cents per bushel at the prices and costs prevailing in 1943. If wheat production is reduced 20 percent, the average cost per bushel sold rises to 90 cents, which is an increase of 12 cents per bushel, because the overhead has to be carried by a smaller output. The price of wheat would have to be $1.20 per bushel to give the operator the same return as he would have if he grew 20 percent more wheat and sold it at $1 per bushel.

This situation is fairly typical on a large number of farms in this country. It means that if total output is reduced the reduction is made in the part of the output that is produced at the lowest cost per unit. The price of the product therefore would have to rise considerably to offset the loss in income from cutting back on the lower cost portion of the output. On typical cash-grain farms in the Corn Belt the volume of production per farm increased 44 percent from 1930-32 to 1944, and the cost per unit of product on these farms decreased 30 percent, after corrections have been made for all changes in prices paid and received. On hog-beef raising farms in the Corn Belt the increase in production from 1930-32 to 1944 was 25 percent, and the cost per unit of product dropped 9 percent after correction for price changes. On dairy farms in southern Wisconsin an increase of 36 percent in production was accompanied by a reduction of 13 percent in cost per unit of product.

If typical Corn Belt farmers were to reduce their production 20 percent their costs per unit of product might rise as much as 15 percent, and prices would have to be 15 to 20 percent higher if farmers were to have the same income as they would have with a 20 percent larger output. On the other hand, the Corn Belt farmers who reduced their costs per unit of product another 20 percent by further adoption of improved practices usually could count on immediate gains from two sources: The wider margin between cost and selling price and the larger output per farm that commonly is associated with such improvements.

But if an improved practice results in a large increase in output, its adoption by a considerable number of farmers would increase the market supplies of that product. This in turn might mean lower prices, and a shifting of part of the gain away from the producers to

other groups. The farmers who can take advantage of improved practices by increasing output per man, however, could retain a large part of the gain from increased efficiency and thus offset the impact of lower prices.

Not all improvements that reduce costs have the effect of increasing output, but a large number of them do. Hybrid-seed corn is a good example. If adoption of hybrid seed results in a 20-percent increase in corn yields per acre, and 15-percent lower costs per bushel of corn, the farmers who adopt hybrid seed gain a great deal, until adoption becomes general enough to increase market supplies to a point at which lower prices are paid. In the past, the general adoption of improved methods has come so slowly that progressive farmers have retained nearly all of their gains for a long time. And if market outlets are expanding, the gains can be held more effectively.

Even when prices do go down as a result of increased production the farmers who use the improvement have the protection of larger output and lower unit costs. It is the farmers who cannot take advantage of cost-reducing improvements that will have lower incomes if the price goes down because of a larger output. The workers who are displaced by a labor-saving improvement also will be disadvantaged unless they can find other and better paying employment.

One important means of making abundant production profitable for a larger group of farmers is to devise educational and other programs that will bring rapid and more general adoption of cost-reducing practices. A dollar saved in cash production expenses is just as important an addition to the farmer's net income as the dollar that originates from sales of the product.

If at the same time that farmers are reducing their costs the market outlets for farm products can be increased--by maintaining a high level of production and purchasing power in the nonfarm sectors of the economy, and by other means--farmers need not fear the tendency of production-increasing improvements to result in lower prices. In fact, they will benefit from both the larger volume of production and the lower cost per unit.

But production within agriculture would still need to be balanced in relation to the needs for different kinds of farm products. The harmonious relationship between conservation and high-level nutrition has been mentioned. However, shifts in the direction of more hay and pasture, that induce production of more milk and meat, need to become the most profitable production alternatives in the areas where such shifts are desirable, if the changes are to be carried out by farmers.

If some kind of Government aid is needed to achieve the harmonious goals of conservation and high-level nutrition such aid could take one of two general forms. One would be to provide high support prices for milk, meat, fruits, and vegetables. This would encourage shifts in production toward such products. But these are commodities that consumers buy in much larger quantities when their prices are relatively low, so higher prices would cut off the part of the market that would be essential in achieving the goal of high-level nutrition. And the potential shift in this direction would then be severely limited by the smaller market outlet.

The other way to aid farmers in achieving both conservation and desirable shifts in production would be to assist in lowering the cost of producing the products that promote conservation and high-level nutrition. To achieve this, emphasis might be placed on improvements that increase the efficiency of producing these products. An expanded "conservation materials" program would contribute to this end. Aid might be extended in obtaining lime, fertilizer, legume and grass seeds, and other materials that are needed in working out long-time farm plans for stable, soil-improving farming systems. Establishment of more stable tenure systems would give farm operators greater financial interest in soil maintenance and improvement. Many farmers would need educational assistance and management guidance also in carrying out such a program. A combination of these measures, as needed on individual farms, would go far toward making the desirable shifts in production the most profitable ones for farmers to carry out.

Special measures might be developed in some areas to capitalize on the potentialities of increasing output per man as mechanization and other improved practices are adopted. Since technical progress means that fewer workers are required in agriculture, that a farm family can operate more acres of land and produce more per acre, it also means fewer farms but a larger total output. Table 7 shows the progress in reducing hours of labor in corn, wheat, and cotton from 1900 to 1940. During the war, labor used per unit of product was reduced along the entire farm front. Gross farm production increased 18 percent from 1939 to 1944, but the total man hours expended for the 1944 production were only 3.6 percent above those used in 1939. And as there were fewer workers on farms, the production per worker in 1944 was 26 percent above the 1939 level.

Farm production in 1944 used about 3 billion fewer man hours than would have been needed under 1939 production conditions. That represents a saving of 1.5 million man years of work at 2,000 hours per worker. The change is accounted for by (1) lower labor requirements per unit of

Table 7.- Average hours of labor used for corn, wheat, and cotton production in 1900, 1920, and 1940

Item	1900	1920	1940
Corn for grain			
Hours per 100 bushels	147	113	83
Yield - bushel	25.9	28.4	30.3
Wheat			
Hours per 100 bushels	108	87	47
Yield - bushel	13.9	13.8	15.9
Cotton			
Hours per bale	283	281	191
Yield - pounds lint	198	160	257

product resulting from increased crop yields per acre, (2) greater mechanization, (3) some shifting out of high-labor crops such as cotton, (4) saving the livestock labor with increased production, and (5) the spreading of overhead and miscellaneous labor over a larger volume of production.

This wartime accomplishment represents rapid progress, but much more startling changes lie ahead if full advantage is taken of the opportunities for reducing labor requirements and for increasing the output per man. For example, mechanical pickers and flame cultivators may soon make it possible to reduce the man hours used per bale of cotton in many areas from the 191 shown in table 7 for 1940 to about one-fourth that figure. If fairly complete mechanization of the cultivation and harvesting of cotton could be attained the man hours used per bale of cotton might be reduced to 65 hours, as a national average. This would release 1.6 billion hours of labor on an output of 13 million bales. That is equivalent to about 800,000 man years of labor at 2,000 hours annually per worker. Expenses per bale of cotton would be greatly reduced. Such a drastic change would probably not come rapidly, but the end result would have a tremendous impact on the South, as well as on the entire national economy.

Changes that would enable agriculture to take full advantage of the potentialities of the new technology would be so sweeping that there is little likelihood that they will ever be completely realized. In many respects this may be fortunate because national welfare cannot be measured solely in terms of efficiency. But it seems apparent that considerable progress in adapting farming to the new technology is desirable and necessary if farmers are to be prosperous.

The distance to be traveled varies greatly by areas and by broad regions. Figure 36 shows the gross farm production per worker by census geographic divisions from 1919 to 1944, compared with the United States average production per worker for the years 1935-39 as the base, or 100 percent. The effects of the drought in the early 1930's and the piling up of workers on farms because of the depression is evident in the curve that shows gross production per worker for the United States. But the influence of drought on production per worker is most evident in the North Central and Mountain divisions.

Gross production per worker in the three Southern divisions has been much lower than the 1935-39 average for the United States throughout the entire period shown in figure 36. These three Southern divisions have had about 50 percent of all the farm workers in the Nation, and have contributed about one-third of the total United States production in most of the interwar and World War II years. With the exception of the drought years, gross production per worker in the West North Central States was 50 to 60 percent above the 1935-39 national average in the interwar period, and it was more than twice that prewar national average in the war years 1942-44. Gross production per worker in the Pacific States has shown a tendency to increase throughout the entire period, 1919-44.

What are some of the factors that cause such wide geographic variations in gross production per worker? Table 8 gives part of the explanation. The South Atlantic and the East South Central States had the lowest gross production per worker in 1939. The acres of cropland, value of land and buildings, and value of livestock per worker, were less than one-half of the national average. And the value of equipment per worker was about one-third of the average for the country as a whole. In other words, the average farm worker in these two Southern divisions had less than half as much land, buildings, and livestock, and had only about one-third as much machinery to help him in his farm-production job as did the average farm worker in the United States.

The figures in table 8 indicate that material increases in production and net income for Southern farm workers are largely dependent upon (1) more capital investment to provide more land, livestock, machinery, fertilizer, and other capital items per worker and (2) oppor-

Table 8.- Gross production per worker and value of land and buildings, livestock and equipment per worker, by census geographic division, 1939 and 1940 1/

Census geographic division	Production per worker, 1939 (U.S. average = 100)	Land and buildings per worker, 1940 2/	Livestock per worker, 1940 2/	Equipment per worker, 1940 2/	Total cropland per worker, 1939 3/
	Percent	Dollars	Dollars	Dollars	Acres
Pacific	166	5,709	443	411	32.1
West North Central	150	5,380	757	533	81.7
East North Central	146	4,995	612	483	38.2
Mountain	140	4,120	921	417	60.6
Middle Atlantic	121	3,191	531	459	21.6
New England	104	2,891	367	289	14.4
West South Central	69	2,266	313	178	30.2
South Atlantic	66	1,511	187	99	13.9
East South Central	50	1,303	201	90	14.9
U. S.	100	3,132	424	285	33.9

1/ Based on number of farm workers from BAE Farm Labor Reports, 1939. Production per worker for 1939 is used because that is the production year reported in the 1940 census.

2/ Value of land and buildings, livestock, and equipment from 1940 Census of Agriculture.

3/ Land from which one or more crops were harvested plus estimated acreage of crop failure and summer fallow.

tunities for nonfarm employment for the young people growing up on farms who will not be needed in farm occupations, and for the workers that will be released from agriculture as mechanization and other improvements gain momentum. These changes are inevitable. They are already under way. The only question is how rapidly the transformation will take place.

Readjustments of this type will create opportunities for farm workers in the South to equal the per capita production and income of farm workers in other regions. But on many farms the change involves shifting from a simple cash-crop type of farming, with hand-and-mule operations, to relatively complex soil-conserving types of farming, that involve forage, pasture, winter cover crops, livestock, mechanical power, and larger farms. This kind of farming requires more management and more mechanical skill for successful operation. In most other areas the shift to mechanization and more complex types of farming has been made gradually, and managerial and mechanical skills have developed as needed. The shift from hand-and-mule operations to the mechanical-power phase is a much more drastic change. It may be retarded by lack of requisite managerial and mechanical skills.

Although the readjustments in Southern farming are likely to be more drastic than changes in other areas the same general process is at work elsewhere. Mechanization and other improvements have increased the size of farm that a family can operate. They have also made farming a much more complex business. This means that successful, modern farming requires less brawn and more brains than the farming of a generation ago, and that it takes a large capital investment to become established on the size of farm that a family can easily handle from a labor standpoint. Some farmers will need new sources of credit to obtain farms of adequate size, and to buy the livestock and equipment needed to operate them. Full-time farms that are too small to utilize mechanical power effectively are also likely to be too small to provide a satisfactory living for a farm family.

Many farmers will need assistance on their problems of management. Public agencies could render service on this front by establishing pilot farms where new developments would be tested, and where farmers could see them in operation. Farmers also could be given further assistance on their farm-planning problems. Encouragement might be given to the organization by farmers of cooperative management associations for employing professional management assistance.

The farmers who can utilize available assistance in adjusting the type and size of their operations to the new techniques are likely to be

rewarded with incomes that compare favorably with earnings in other occupations. And such rewards are necessary if farming is to attract a proportionate share of the capable youth who are choosing their life occupations.

But it should also be recognized that there are large groups of farm people who cannot benefit from mechanization and associated improvements. There are those who are best fitted for farm work, but who cannot readily adapt themselves to the new techniques. Many in this group are older people who look forward to retirement; but some younger workers will not be able to operate farms of the size and complexity required by the new techniques. Perhaps this group can develop relatively simple types of farming which, even though somewhat less profitable, are better suited for their capacities than the more highly mechanized and complex operations. Some will find their best opportunities as hired farm workers. Better housing and more adequate security are problems of major importance to the hired labor groups.

The largest group among those who are likely to be disadvantaged by the more complete shift to the mechanical-power phase and associated improvements are the ones who will need to seek employment elsewhere because their work will no longer be needed in agriculture. If a high level of industrial activity is maintained, other work opportunities will be available. But even so, the shift to new work and a new environment will be difficult. Employment offices in rural areas will be needed to inform workers of job opportunities. Many will require preliminary training for other occupations.

Modern transportation makes it possible for more people to combine rural living with nonfarm work. It would therefore be possible to expand the number of part-time farms and rural homes at the same time as many workers shifted to nonfarm employment for their major source of income.

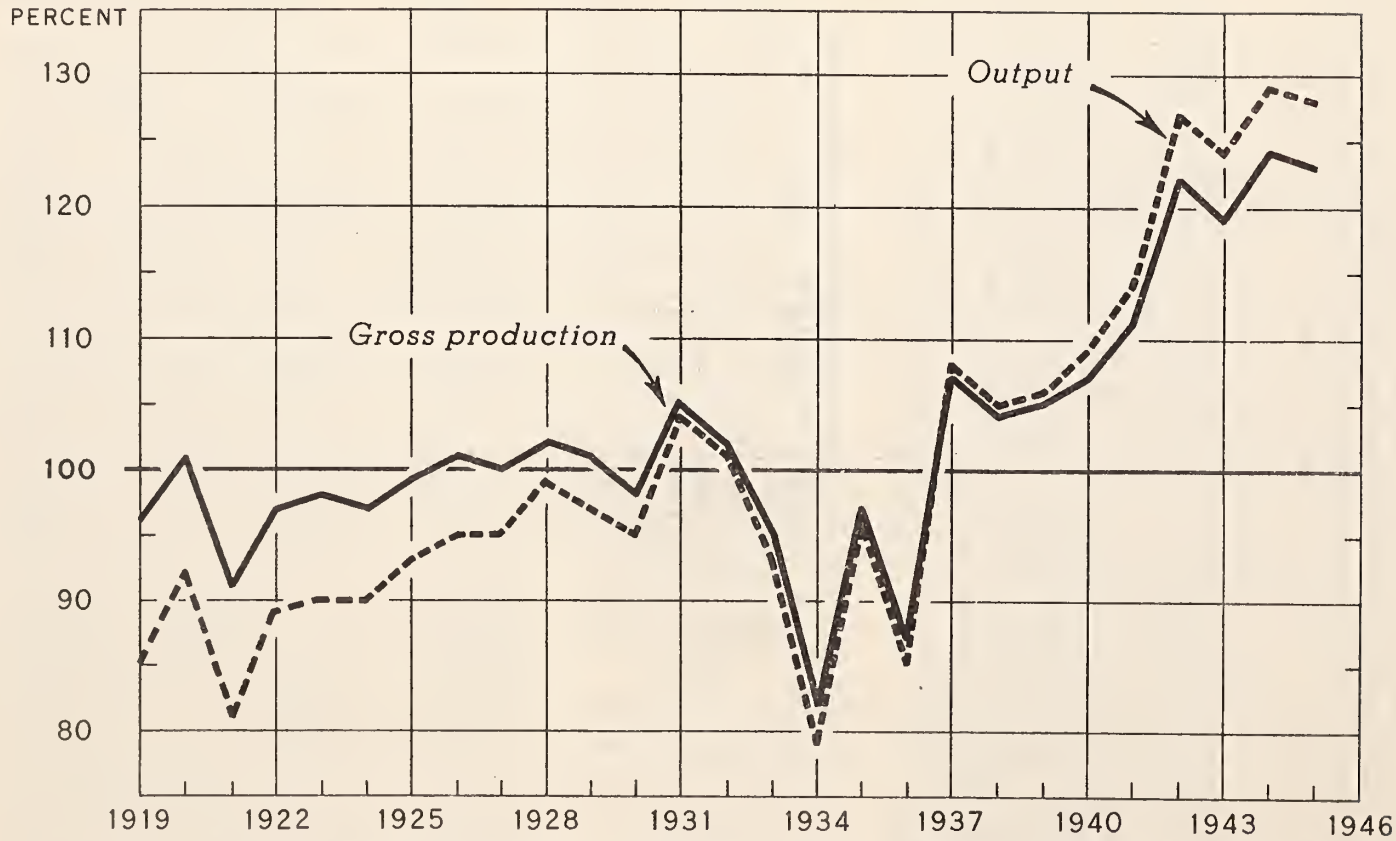
A high level of economic activity will need to be maintained if the displaced workers in agriculture are to be absorbed in other occupations. Figure 6 indicates that progress in technology has increased output per man in other industries in the same way as in agriculture. This means that a market must be found for a greatly increased industrial output. To a very large extent, increased employment at high wages can create its own market, if consumers are permitted to share the benefits of improvement in the form of lower prices. But as output from the productive plant of this country is increased it may become highly desirable to shift more effort into the service occupations--into the health and educational professions, into recreation, and into other professions and services that will provide better living for all the people.

A high level of production is not an end in itself. It is only one of the means to achievement of a better way of living. As increased efficiency is developed in both agriculture and industry less work will be required to produce both food and other products. More time will be available for other things including recreation and increased leisure.

Farmers can retain for themselves some of the real benefits from agricultural improvement if they will take effective steps to utilize the first results. These steps include (1) slackening the pace of farm work and increasing the leisure time available for the entire farm family, (2) investing increased earnings in education and health, and in home conveniences, and (3) refraining from capitalizing increased earnings into higher land values, which make the business of farming more hazardous and less profitable for themselves and for their children. Better farming should mean better living.

GROSS FARM PRODUCTION AND FARM OUTPUT, UNITED STATES, 1919-45*

INDEX NUMBERS (1935-39=100)



*PRELIMINARY. GROSS FARM PRODUCTION MEASURES THE TOTAL PRODUCT OBTAINED FROM FARM LAND AND FARM LABOR RESOURCES IN EACH CALENDAR YEAR. FARM-PRODUCED POWER, WHICH IS MEASURED BY THE COST IN 1935-39 AVERAGE DOLLARS OF RAISING AND MAINTAINING FARM HORSES AND MULES, IS INCLUDED IN GROSS FARM PRODUCTION BUT IS EXCLUDED IN MEASURING FARM OUTPUT. DATA FOR 1944 AND 1945 ARE PRELIMINARY

U. S. DEPARTMENT OF AGRICULTURE NEG. 45548 BUREAU OF AGRICULTURAL ECONOMICS

Figure 1.- Gross farm production increased 22 percent during the war period 1942-44 over the pre-war period 1935-39. The higher increase in farm output was the result of transfer of production resources from horse and mule production and maintenance to production of other livestock and crops for sale.

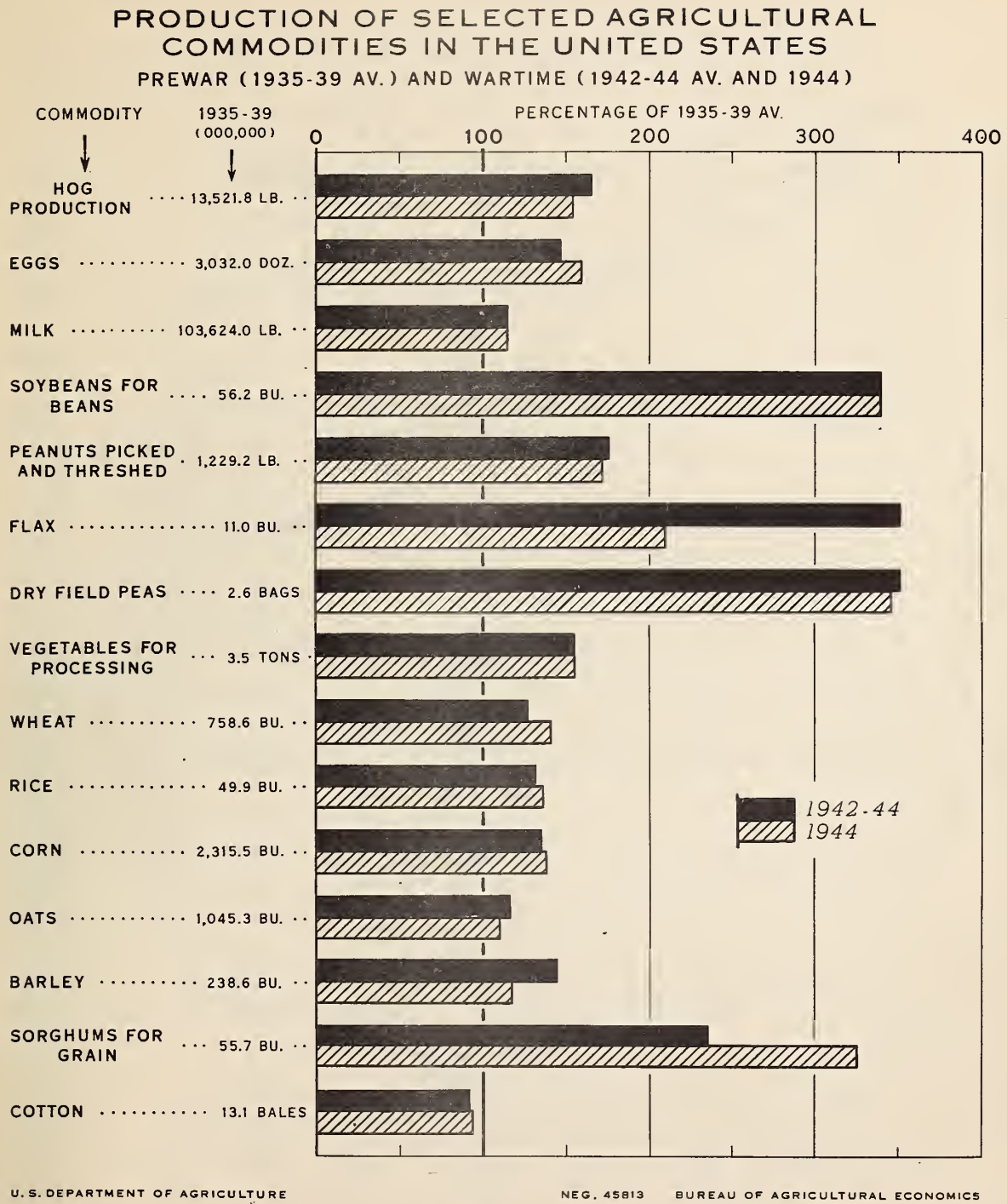
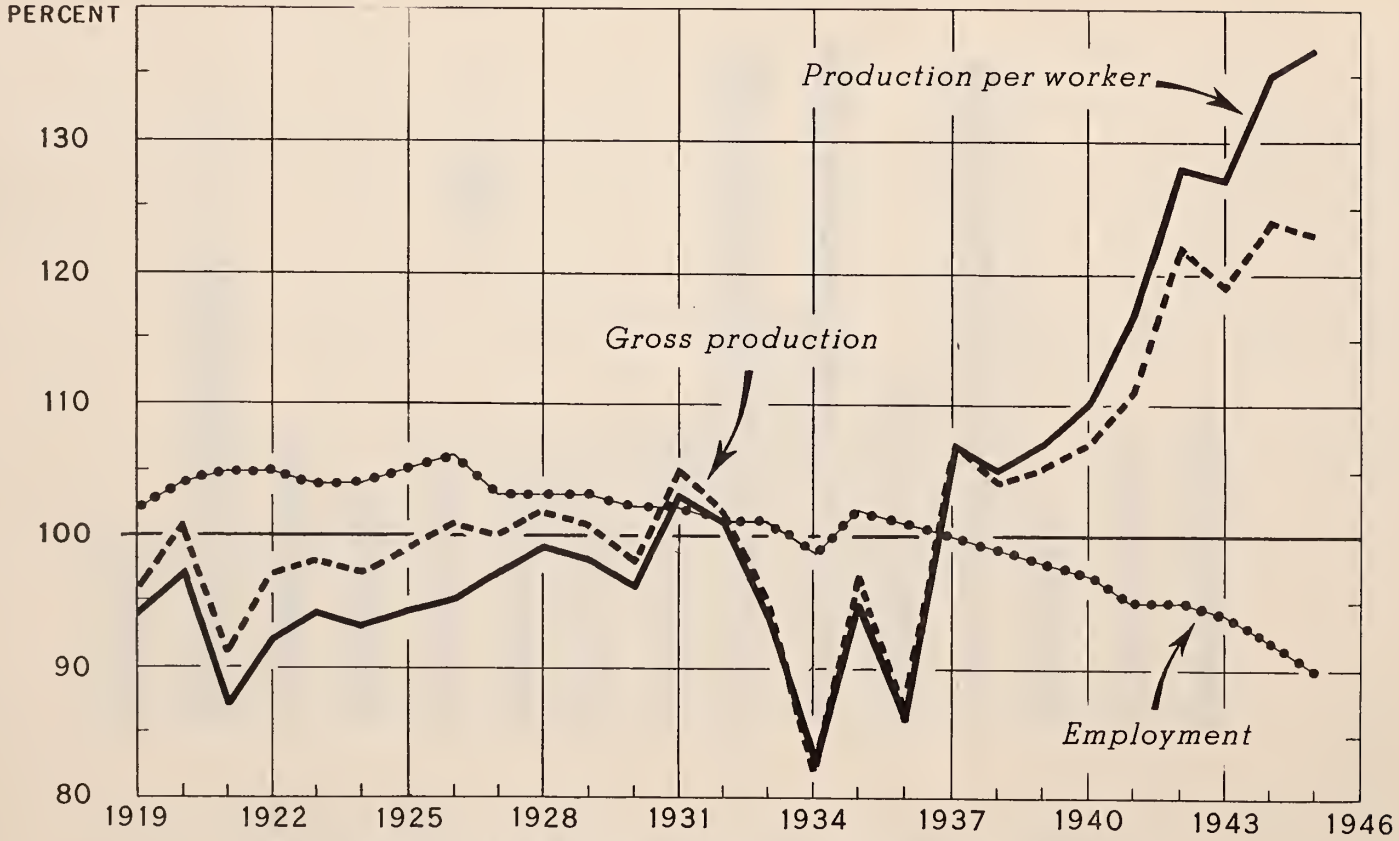


Figure 2.- Production of nearly all the principal agricultural commodities increased in the war years. The sharp advances in hog production and in oil crops reflect responses to the acute need for fats and oils. The phenomenal increase indicated for dry field peas is of less over-all importance than some of the smaller percentage increases registered from a larger prewar base such as those for eggs and milk.

GROSS FARM PRODUCTION, FARM EMPLOYMENT, AND GROSS PRODUCTION PER WORKER, UNITED STATES, 1919-45*

INDEX NUMBERS (1935-39=100)



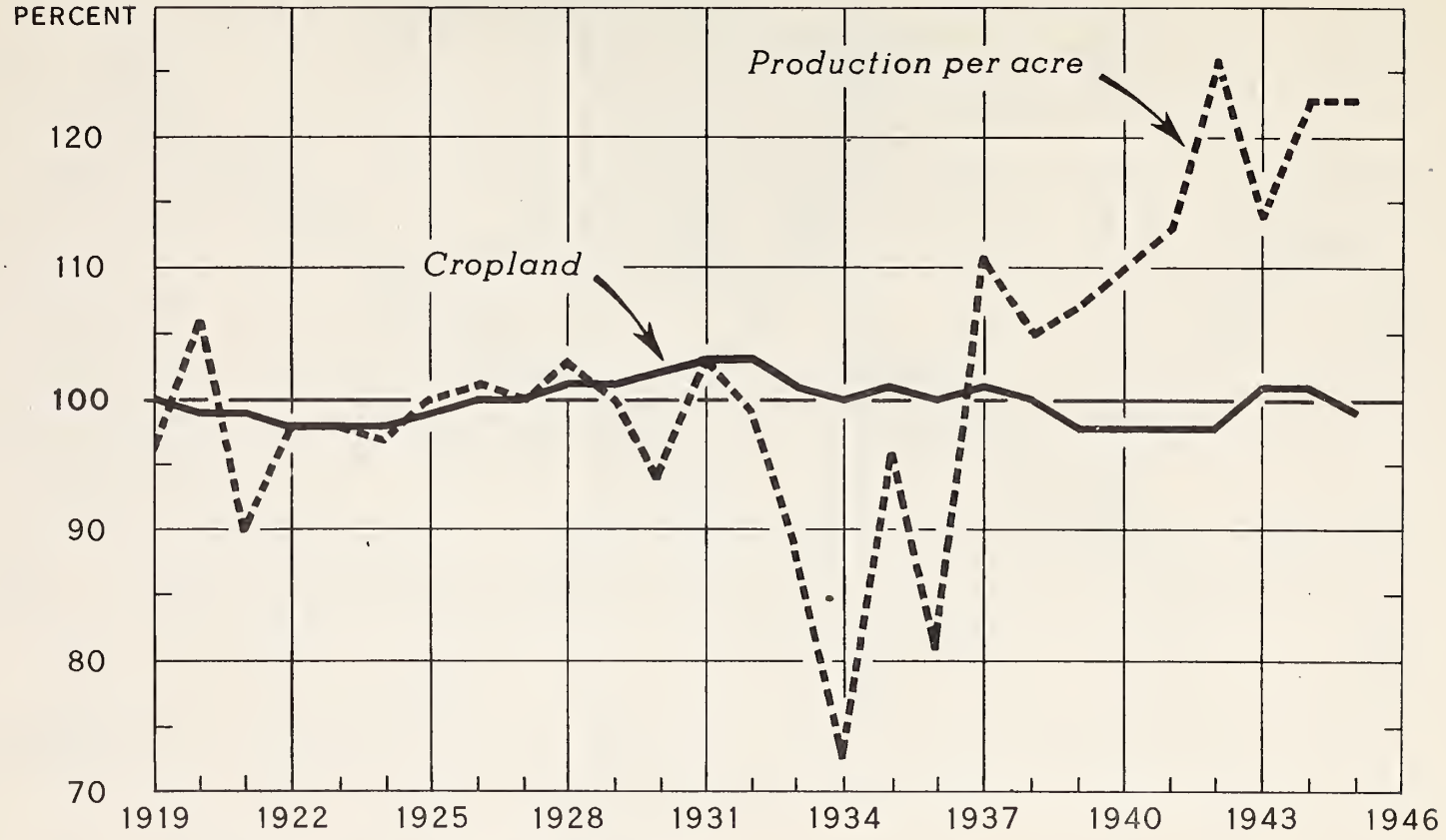
*PRELIMINARY. GROSS FARM PRODUCTION MEASURES THE TOTAL PRODUCT OBTAINED FROM FARM LAND AND FARM LABOR RESOURCES IN EACH CALENDAR YEAR.
DATA FOR 1944 AND 1945 ARE PRELIMINARY

U. S. DEPARTMENT OF AGRICULTURE NEG. 45547 BUREAU OF AGRICULTURAL ECONOMICS

Figure 3.- Acceleration during the war of the long-time downward trend in farm employment, coupled with marked wartime increases in farm production, resulted in record levels of production per farm worker.

TOTAL CROPLAND, AND CROP PRODUCTION PER ACRE, UNITED STATES, 1919-45*

INDEX NUMBERS (1935-39=100)



DATA FOR 1944 AND 1945 ARE PRELIMINARY

** TOTAL CROPLAND IS THE SUM OF THE ESTIMATED ACREAGE OF LAND FROM WHICH ONE OR MORE CROPS WERE HARVESTED PLUS ESTIMATED CROP FAILURE AND SUMMER FALLOW ACREAGE.*

U. S. DEPARTMENT OF AGRICULTURE NEG. 45549 BUREAU OF AGRICULTURAL ECONOMICS

Figure 4.- Increased crop production per acre was by far the most important single factor responsible for record wartime farm production. Total cropland has changed very little during the period from 1919 to 1939.

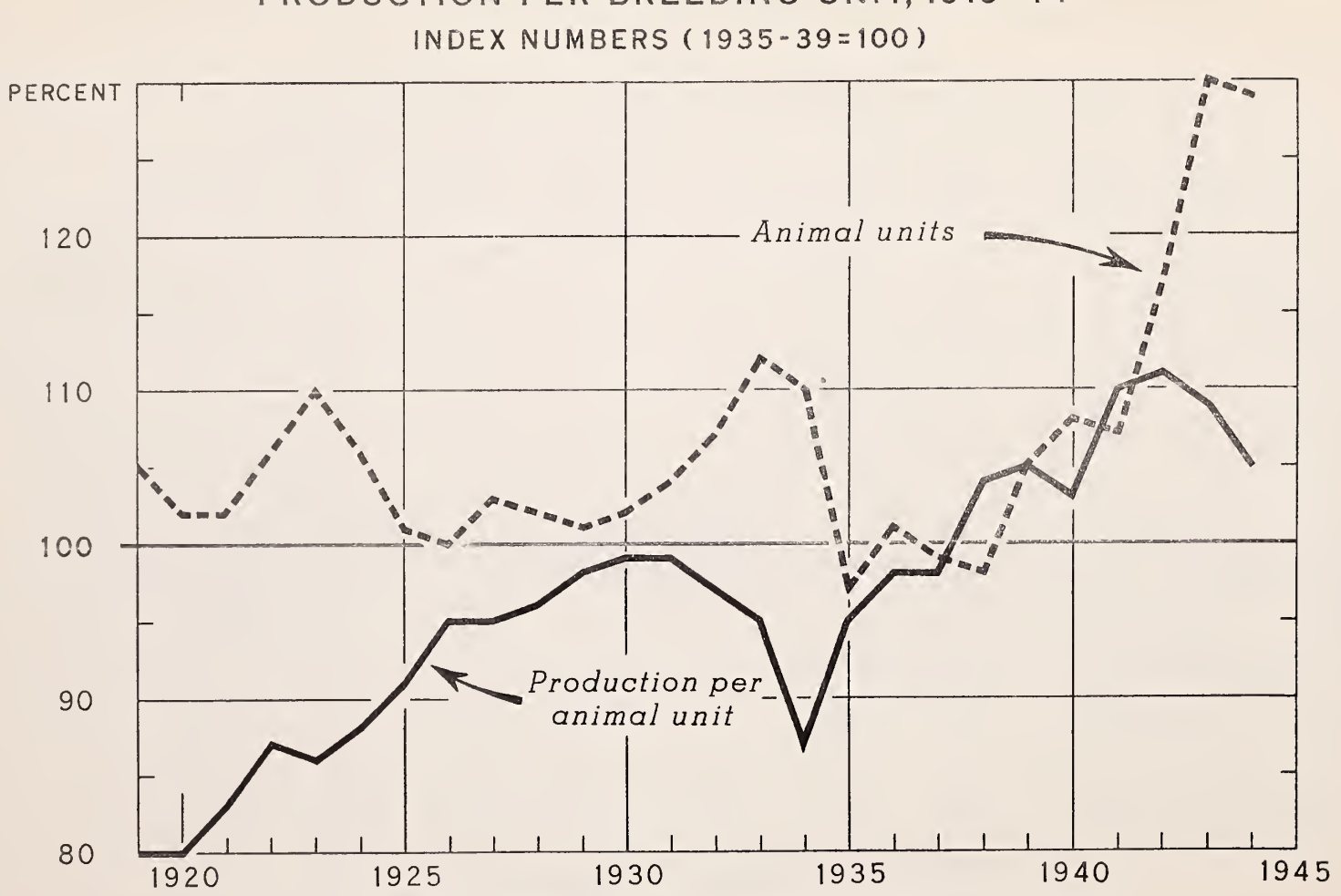


Figure 5.- Livestock production per animal unit of breeding stock has shown an upward trend since 1920, and the animal units of breeding livestock have increased sharply in recent years. The wartime increases in livestock production therefore have resulted both from increases in number of breeding animal units and in production per unit.

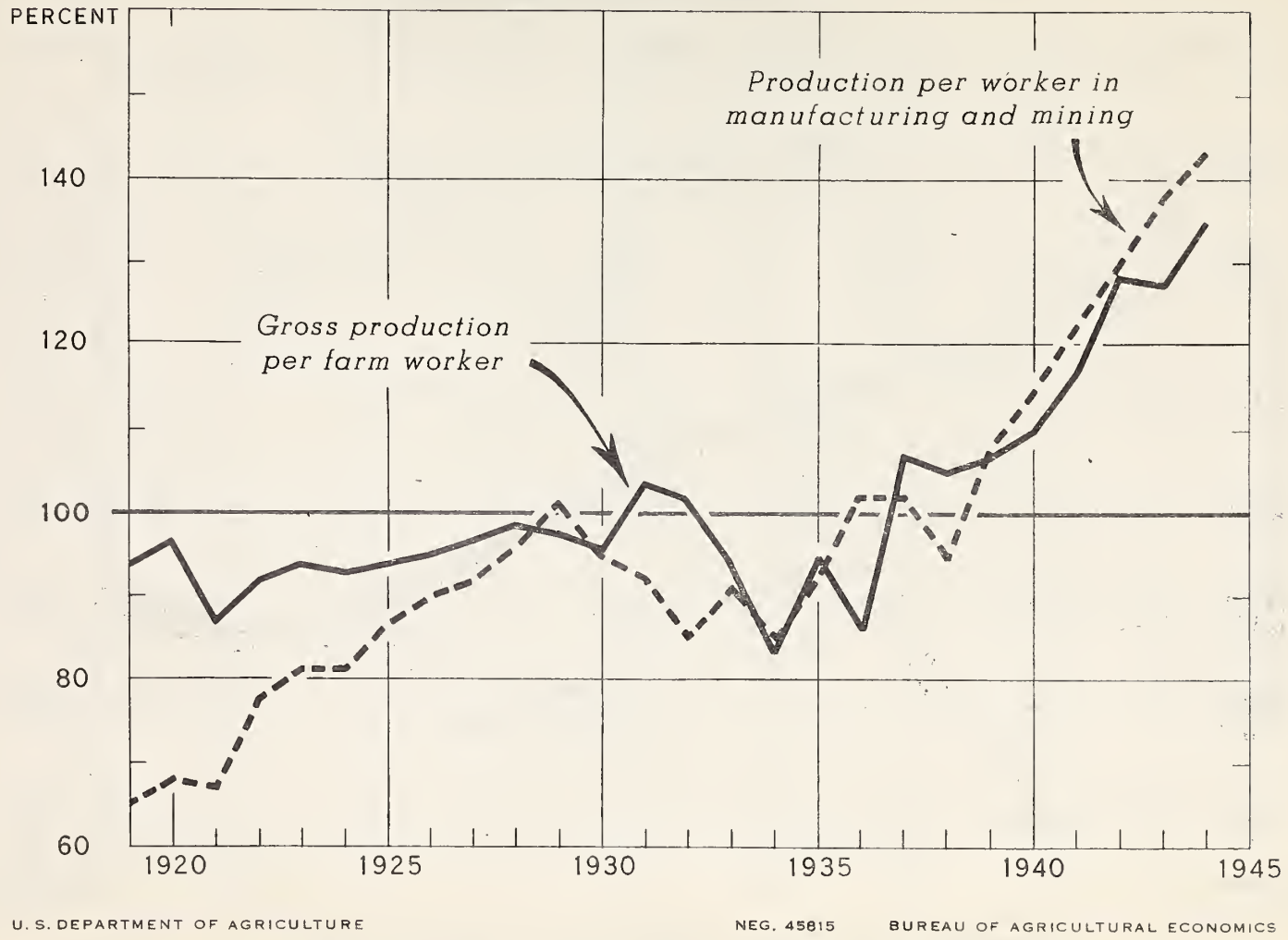


Figure 6.- Increases in production per worker in agriculture matched those of industrial workers during the war, but production per worker in industry has risen more rapidly than that of farm workers over the last quarter-century.

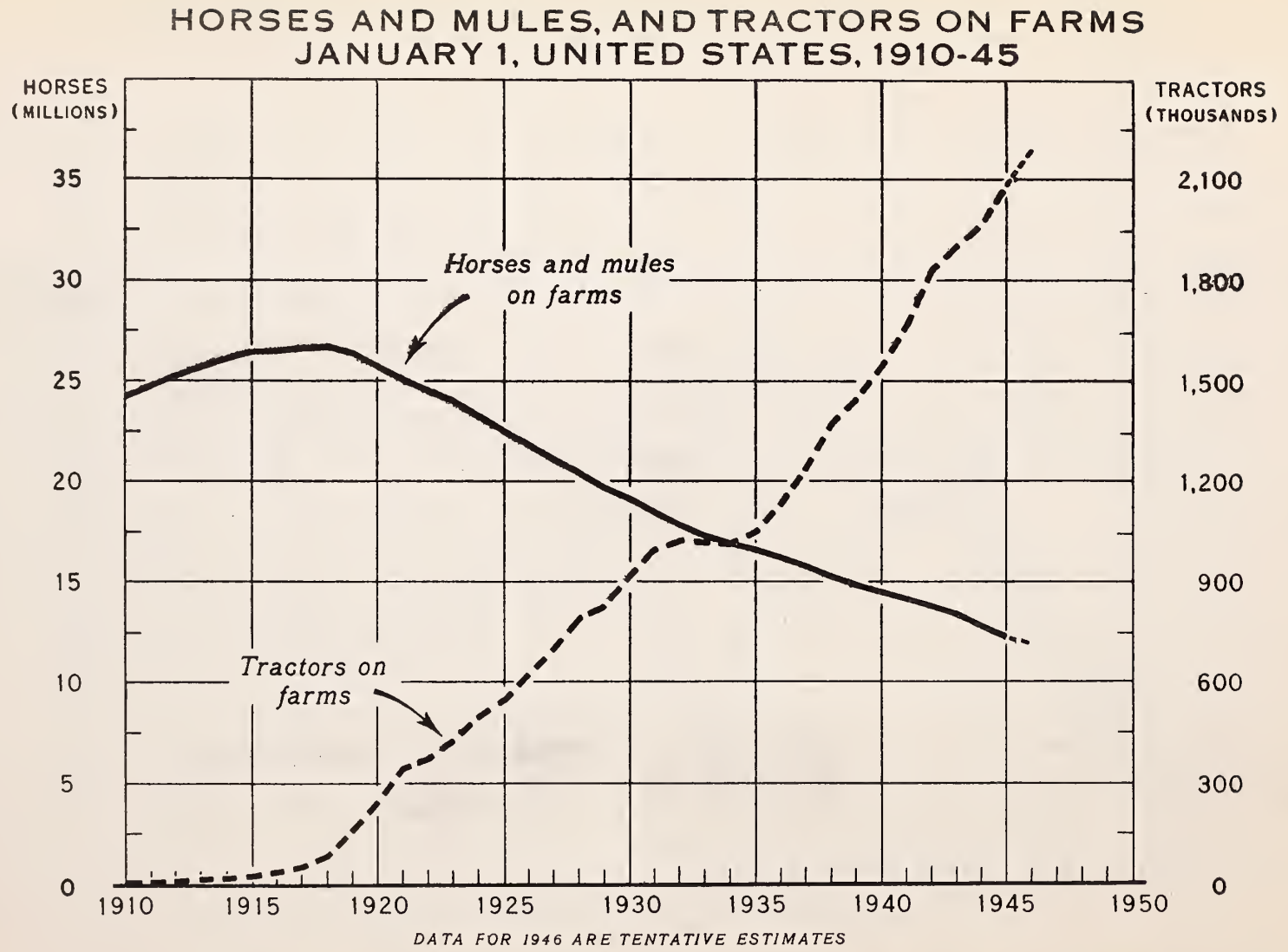


Figure 7.- Tractors have rapidly been replacing animal power for farm production. The number of tractors on farms increased sharply during World War I and in the 1920's. This trend was interrupted in the drought and depression years 1931-35 but was resumed in the late 1930's and early 1940's. The number on farms January 1, 1945 was 2,072,000.

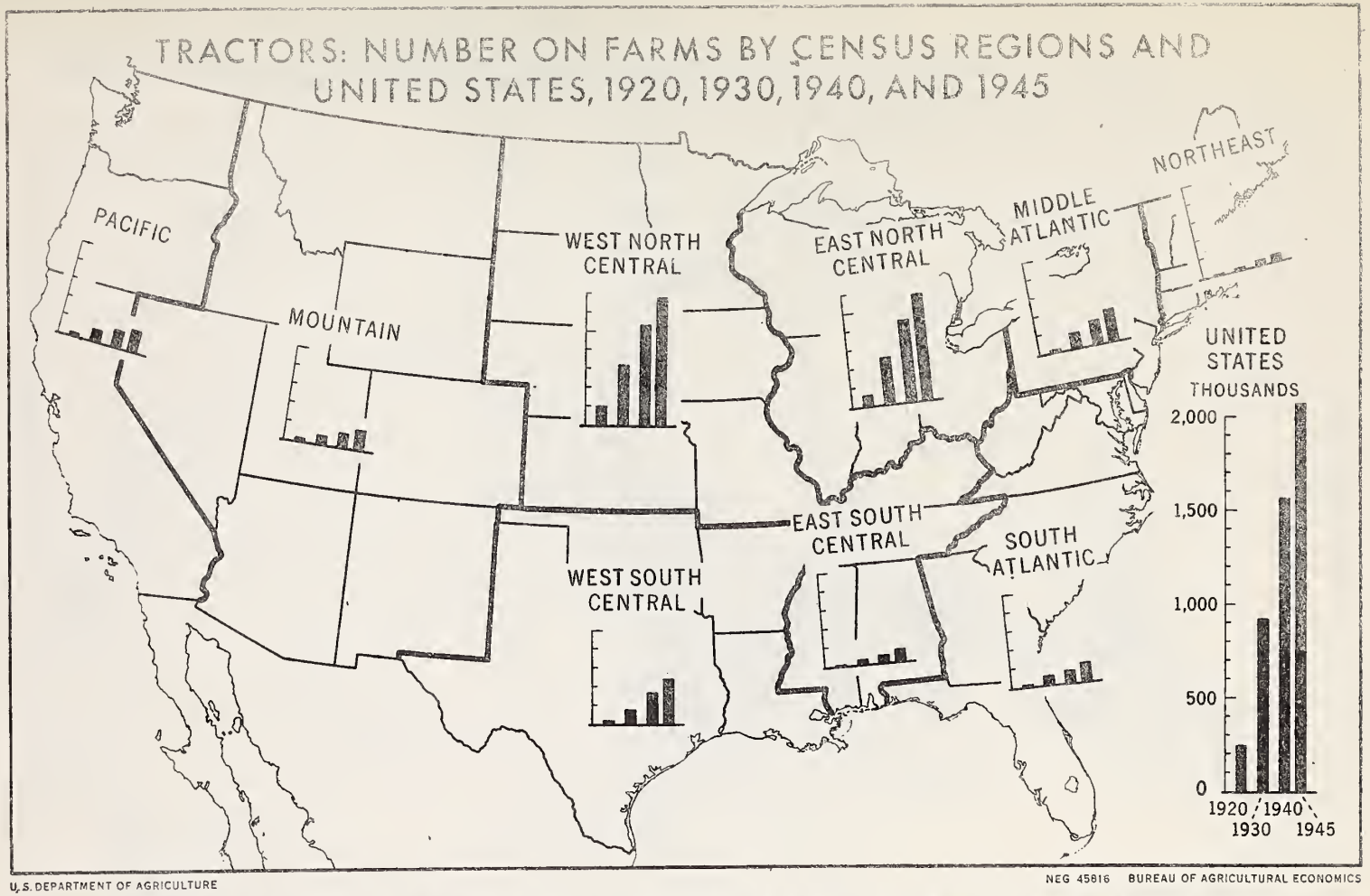


Figure 8.- The shift from horses and mules to tractors has been most rapid in the Great Plains, Corn Belt, and Western States.

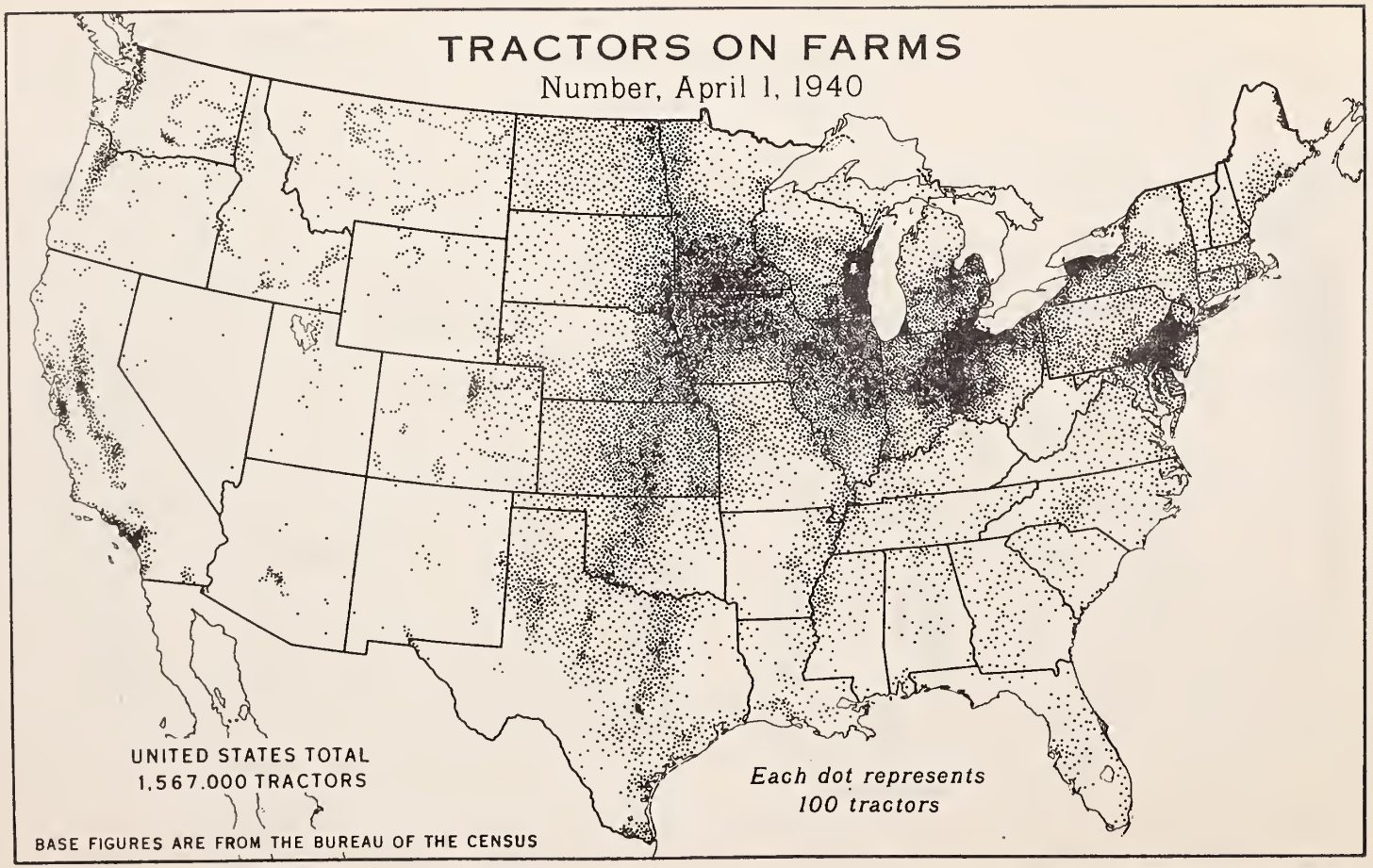
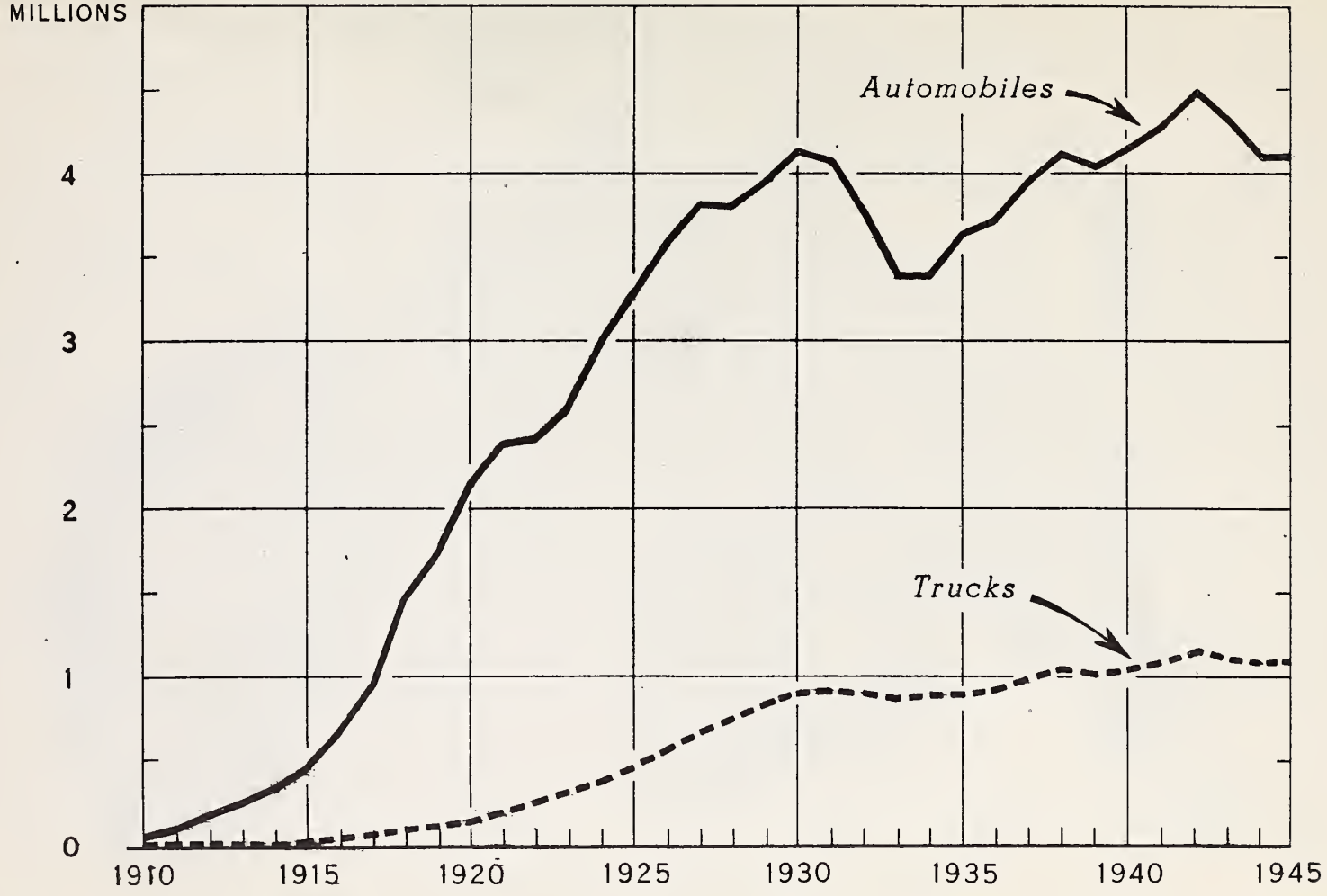

TRACTORS ON FARMS
Number, April 1, 1940
UNITED STATES TOTAL
1,567,000 TRACTORS
Each dot represents
100 tractors
BASE FIGURES ARE FROM THE BUREAU OF THE CENSUS
U. S. DEPARTMENT OF AGRICULTURE
NEG. 39741 BUREAU OF AGRICULTURAL ECONOMICS

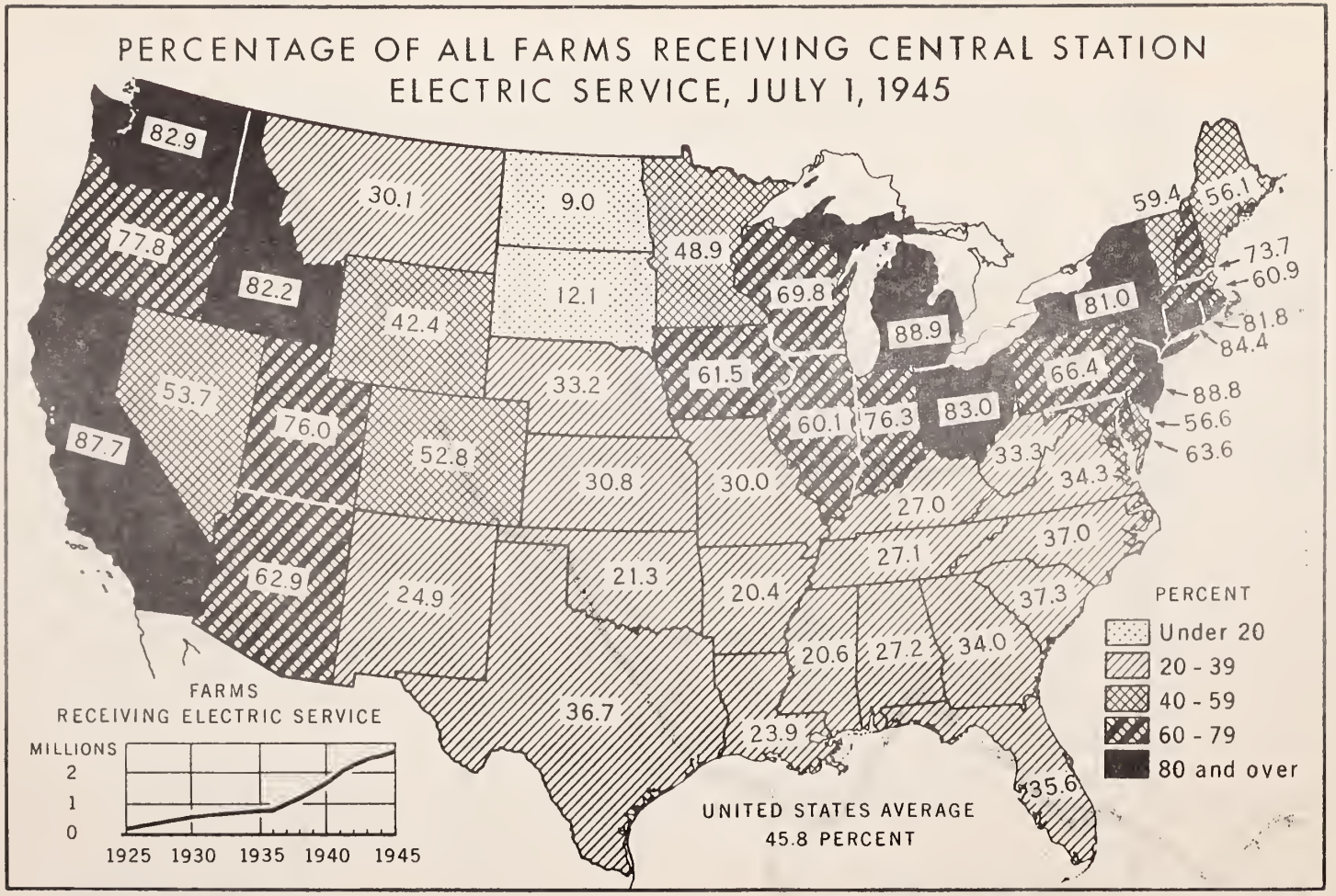
Figure 9.- The greatest concentration of tractors in the country in 1940 was in the Midwest; some smaller areas in other parts of the country also showed heavy concentration of tractors.

AUTOMOBILES AND TRUCKS: NUMBER ON FARMS JANUARY 1, UNITED STATES, 1910-45



U. S. DEPARTMENT OF AGRICULTURE NEG. 45817 BUREAU OF AGRICULTURAL ECONOMICS

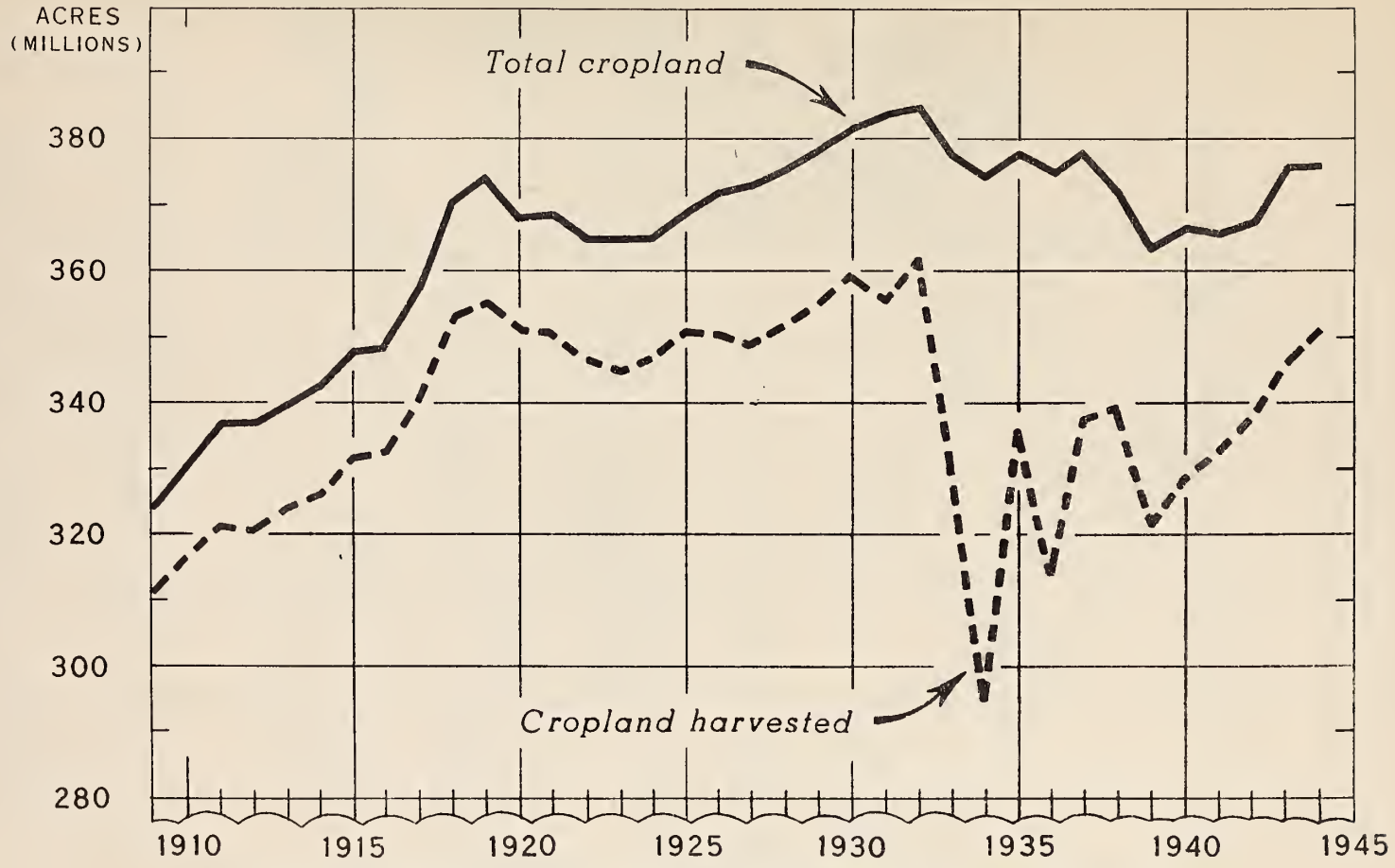
Figure 10.- Automobiles and trucks on farms have increased in the same way as tractors, except for the depression years and during World War II.



U. S. DEPARTMENT OF AGRICULTURE NEG. 45818 BUREAU OF AGRICULTURAL ECONOMICS

Figure 11.- More than 10 times as many farms were equipped with central-station electric service in 1945 as in 1925. In 1945 2,725,645 farmers had central-station service. In addition, more than 200,000 farms had their own lighting plants.

TOTAL CROPLAND* AND CROPLAND HARVESTED,Δ UNITED STATES, 1909-44



*CROPLAND HARVESTED + FAILURE AND FALLOW LAND. DOES NOT INCLUDE ROTATION PASTURE

ΔCROPLAND HARVESTED, ADJUSTED FOR MULTIPLE USE

U. S. DEPARTMENT OF AGRICULTURE NEG. 45819 BUREAU OF AGRICULTURAL ECONOMICS

Figure 12.- Total cropland acreage increased substantially in the decade preceding World War I, and moderately in the first postwar decade. During World War II cropland acreage was approximately the same as in World War I.

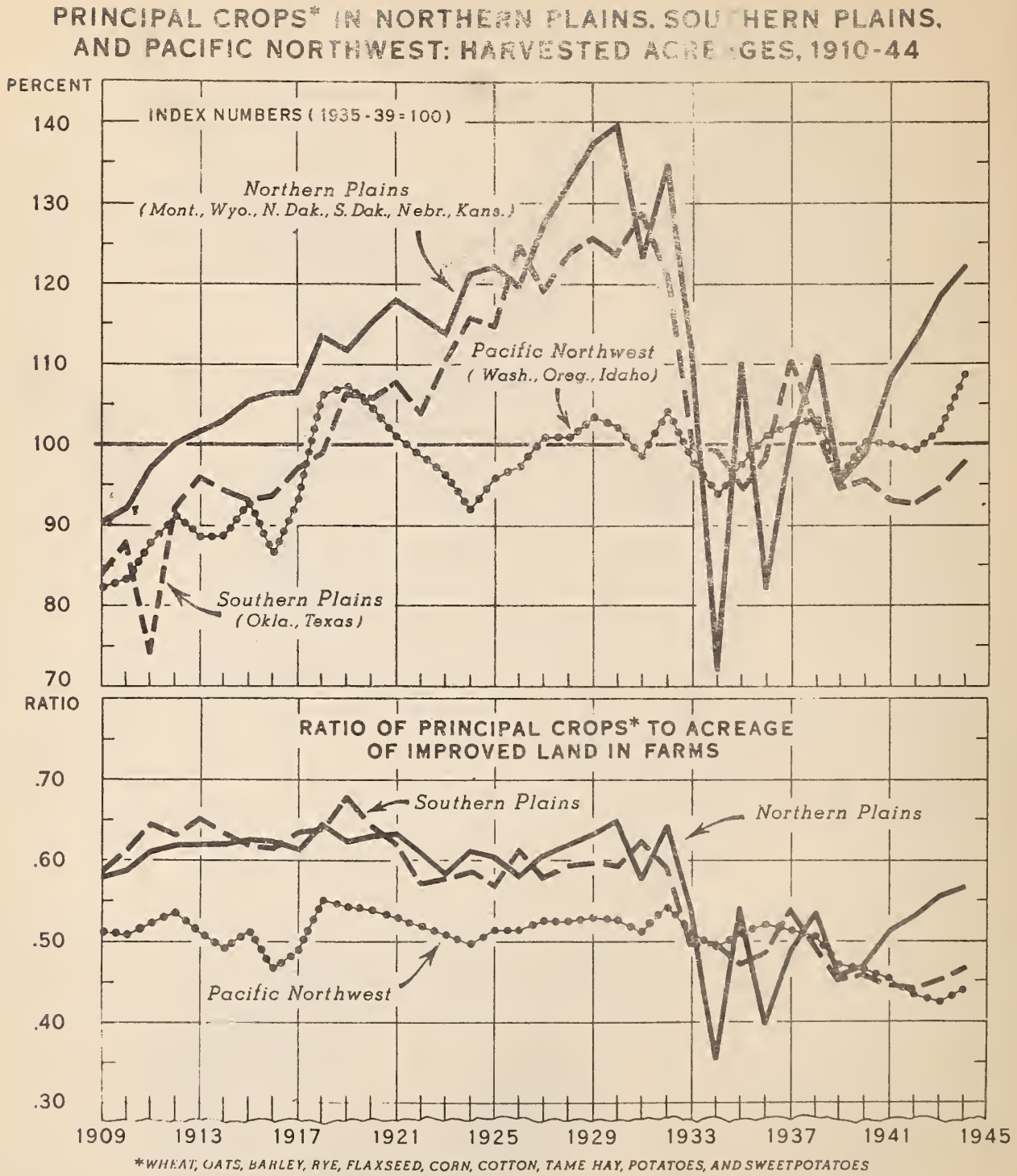
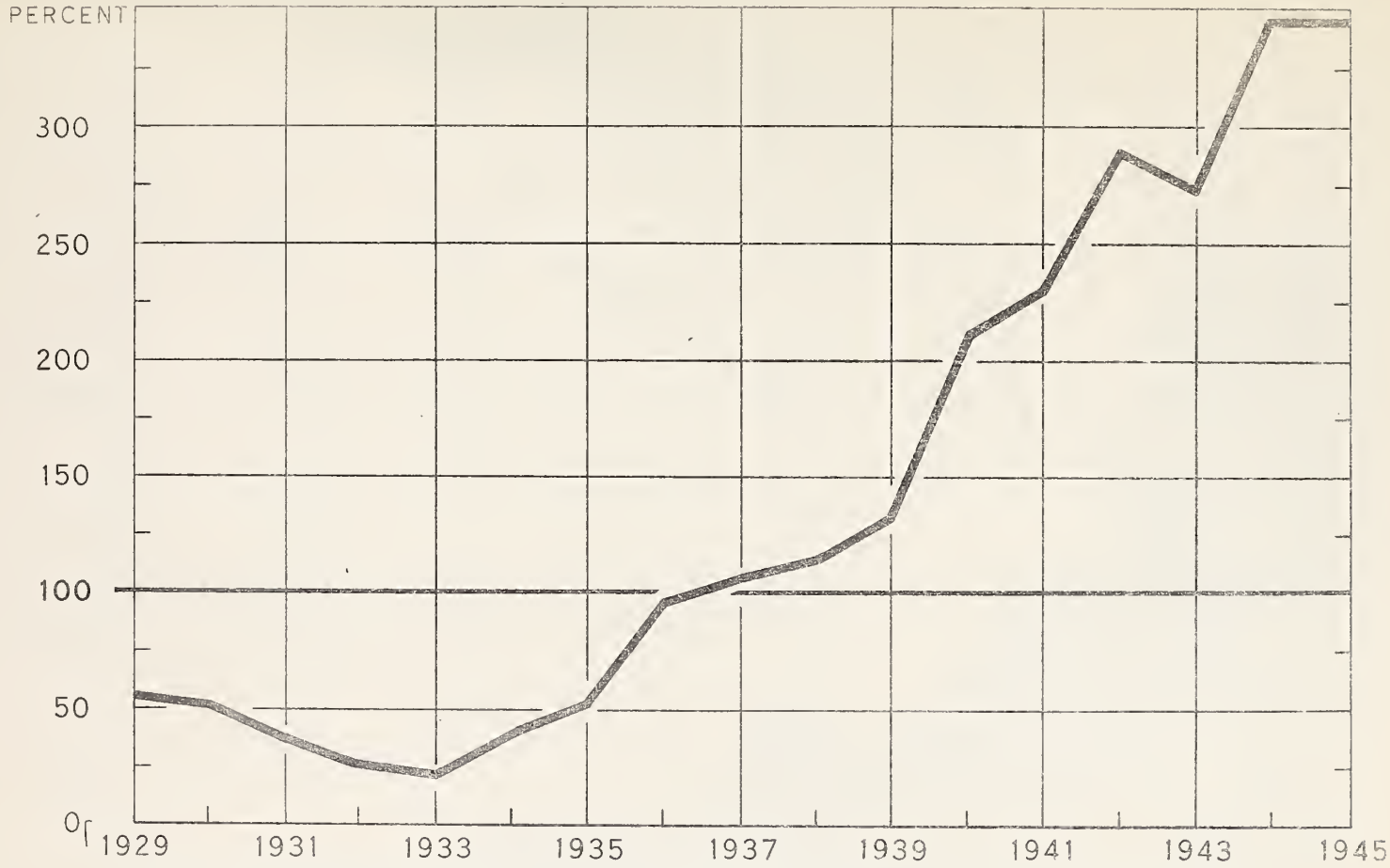


Figure 13.- The acreage of principal crops in both Northern and Southern Plains was higher following World War I than levels reached at any time during World War II. The ratio of acreage of principal crops to improved land in farms was lower in all three regions during World War II, than during the period of expansion that preceded the drought and depression. Sorghums are not included among the principal crops in this chart, because data are not available for earlier years. Adding sorghums for recent years does not change the general trend.

LIME CONSUMPTION IN THE UNITED STATES, 1929-45*

INDEX NUMBERS (1935-39=100)



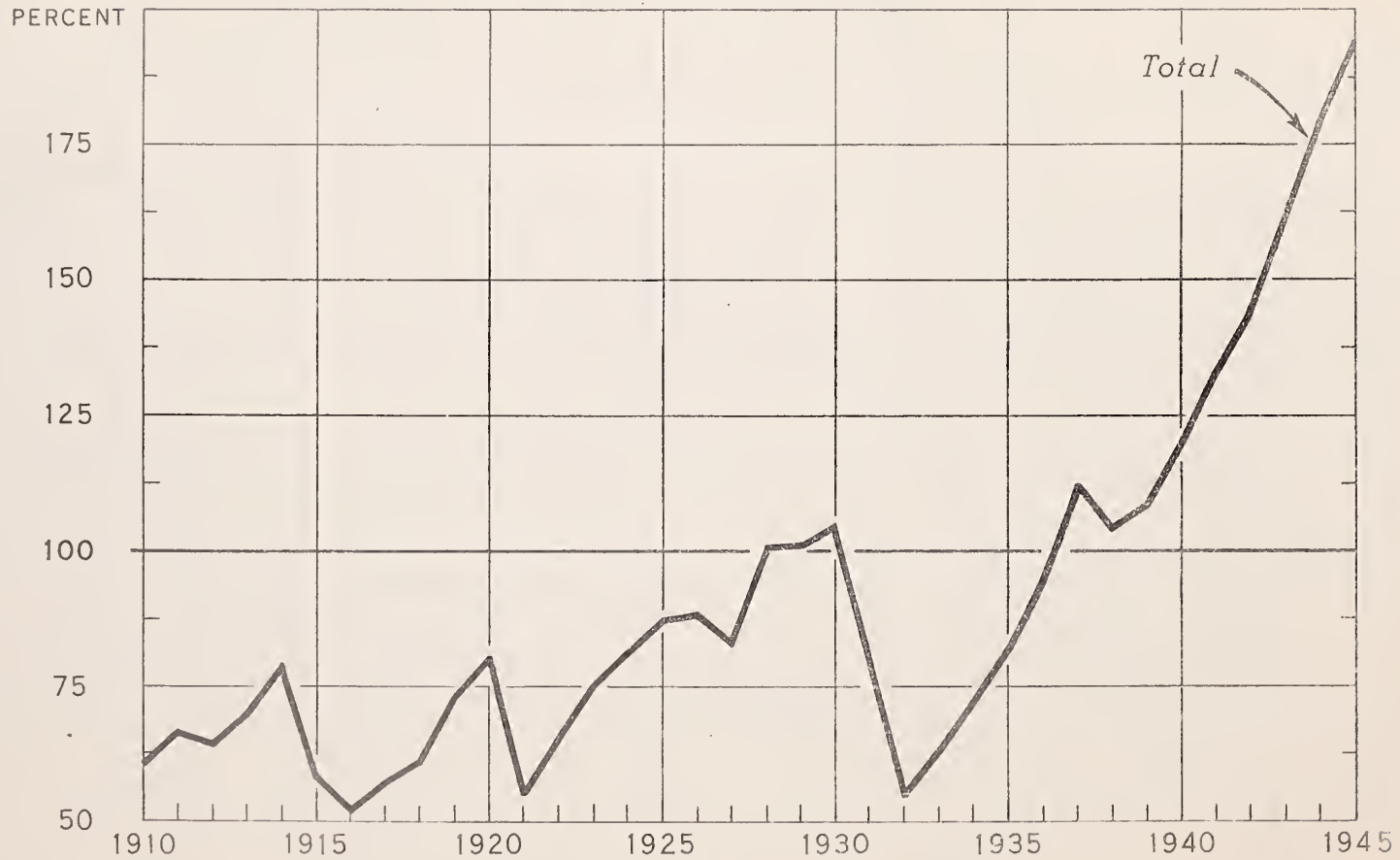
*PRELIMINARY DATA FROM A A A BASED ON SURVEYS MADE BY STATE AGRICULTURAL COLLEGE AGRONOMISTS.
INCLUDES ALL LIMING MATERIALS CONVERTED TO A GROUND LIMESTONE BASIS

U. S. DEPARTMENT OF AGRICULTURE NEG. 45940 BUREAU OF AGRICULTURAL ECONOMICS

Figure 14.- Application of liming materials rose to predepression levels by 1935. Most of the increase in the use of lime since 1936 can be attributed to the stimulation provided by its inclusion as a conservation material in the Agricultural Conservation Program.

FERTILIZER CONSUMPTION IN TERMS OF NITROGEN, PHOSPHORIC ACID, AND POTASH, CONTINENTAL UNITED STATES, 1910-45 *

INDEX NUMBERS (1935-39=100)

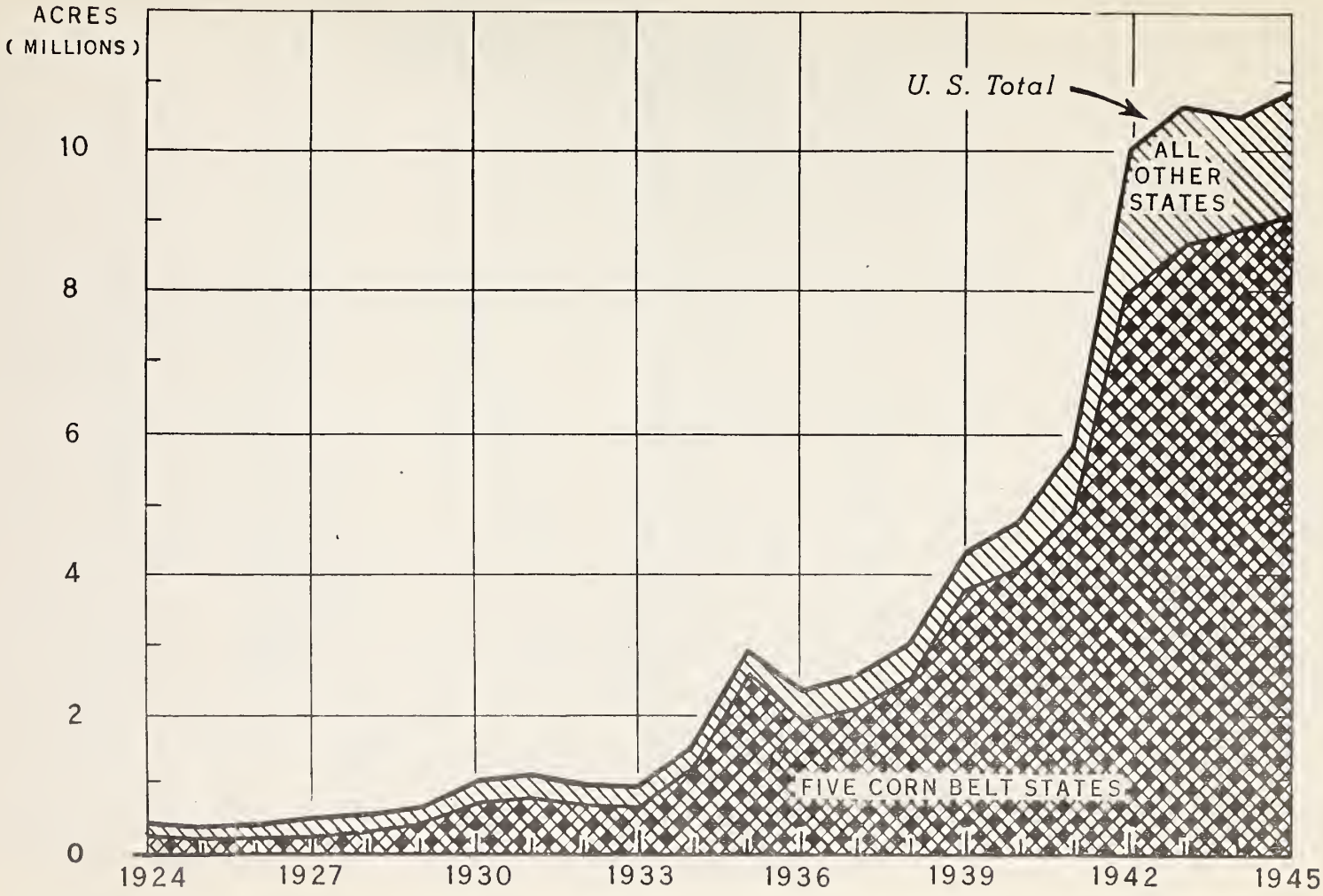


* COMPUTED FROM DATA SUPPLIED BY P.I.S.A.E., A.A.A. AND T.V.A.
DATA FOR 1945 ARE ESTIMATED

U S DEPARTMENT OF AGRICULTURE NEG. 43920 BUREAU OF AGRICULTURAL ECONOMICS

Figure 15.- Use of nitrogen, phosphoric acid, and potash as fertilizer during World War II reached a level nearly double that of the 1935-39 average. The highest consumption before 1937 occurred in 1930, when the level reached was 5 percent above the average of the years 1935-39.

SOYBEANS: ACREAGE HARVESTED FOR BEANS, UNITED STATES, AND FIVE CORN BELT STATES, 1924-45



U. S. DEPARTMENT OF AGRICULTURE NEG. 45368 BUREAU OF AGRICULTURAL ECONOMICS

Figure 16.- The acreage of soybeans harvested for beans in the United States increased gradually from less than a half-million acres in 1924 to about a million acres in the early 1930's and then rose sharply. The wartime level exceeded 10 million acres.

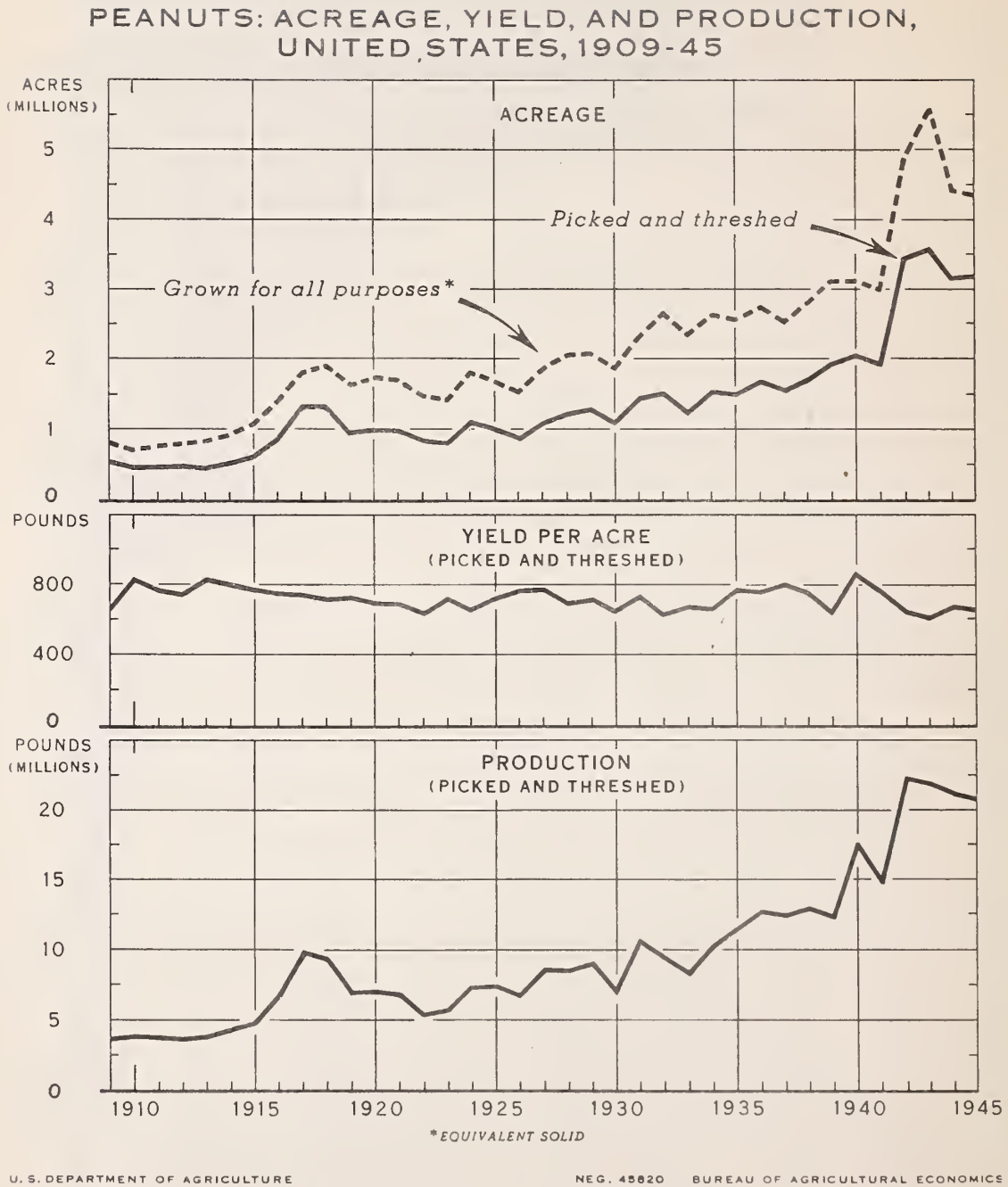


Figure 17.- The acreage of peanuts, picked and threshed, nearly doubled during the war, following the more gradual upward trend of the interwar years. Wartime production did not rise quite so much as acreage because yields declined slightly with expansion into new areas, and on farms of new growers in old areas.

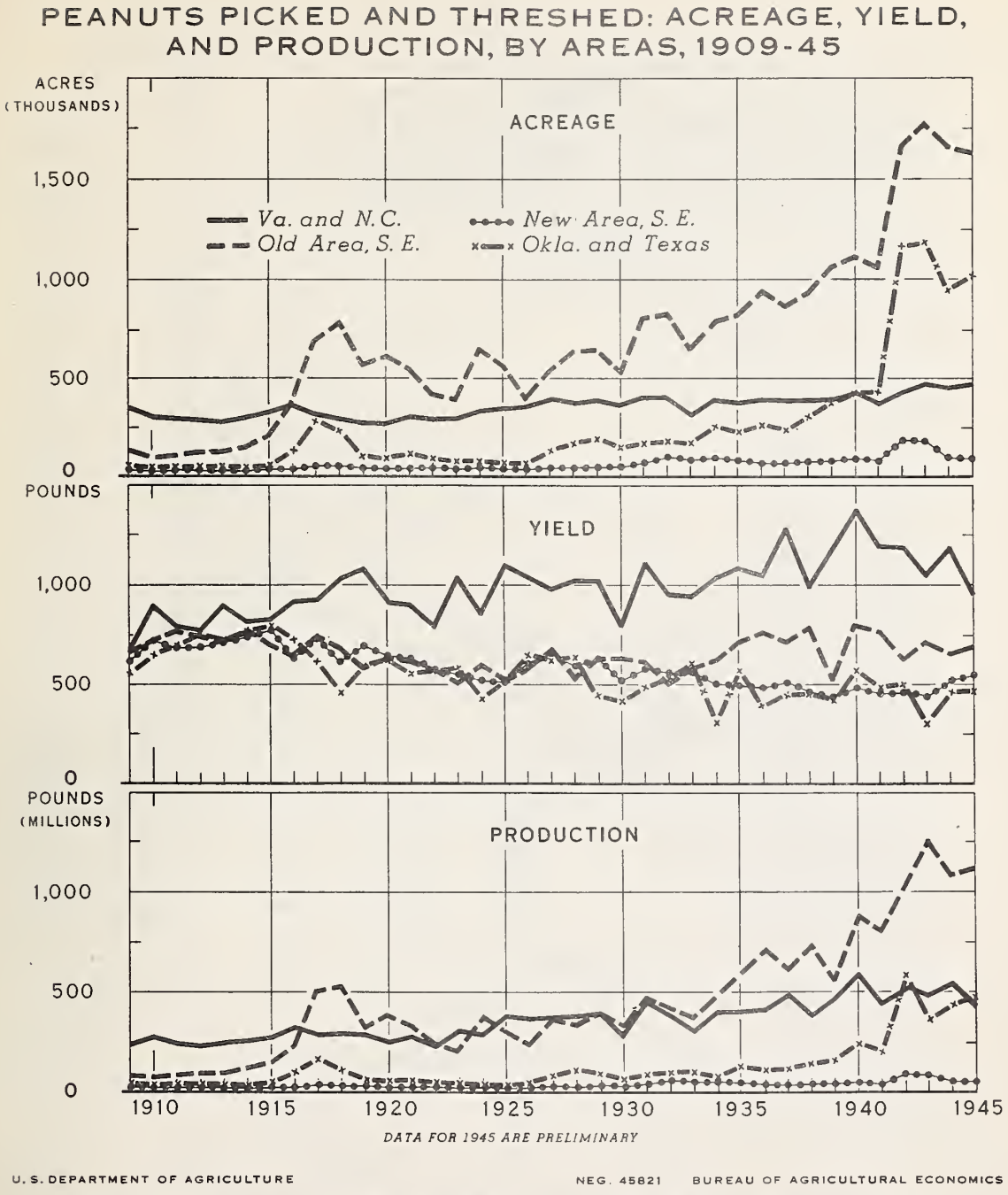
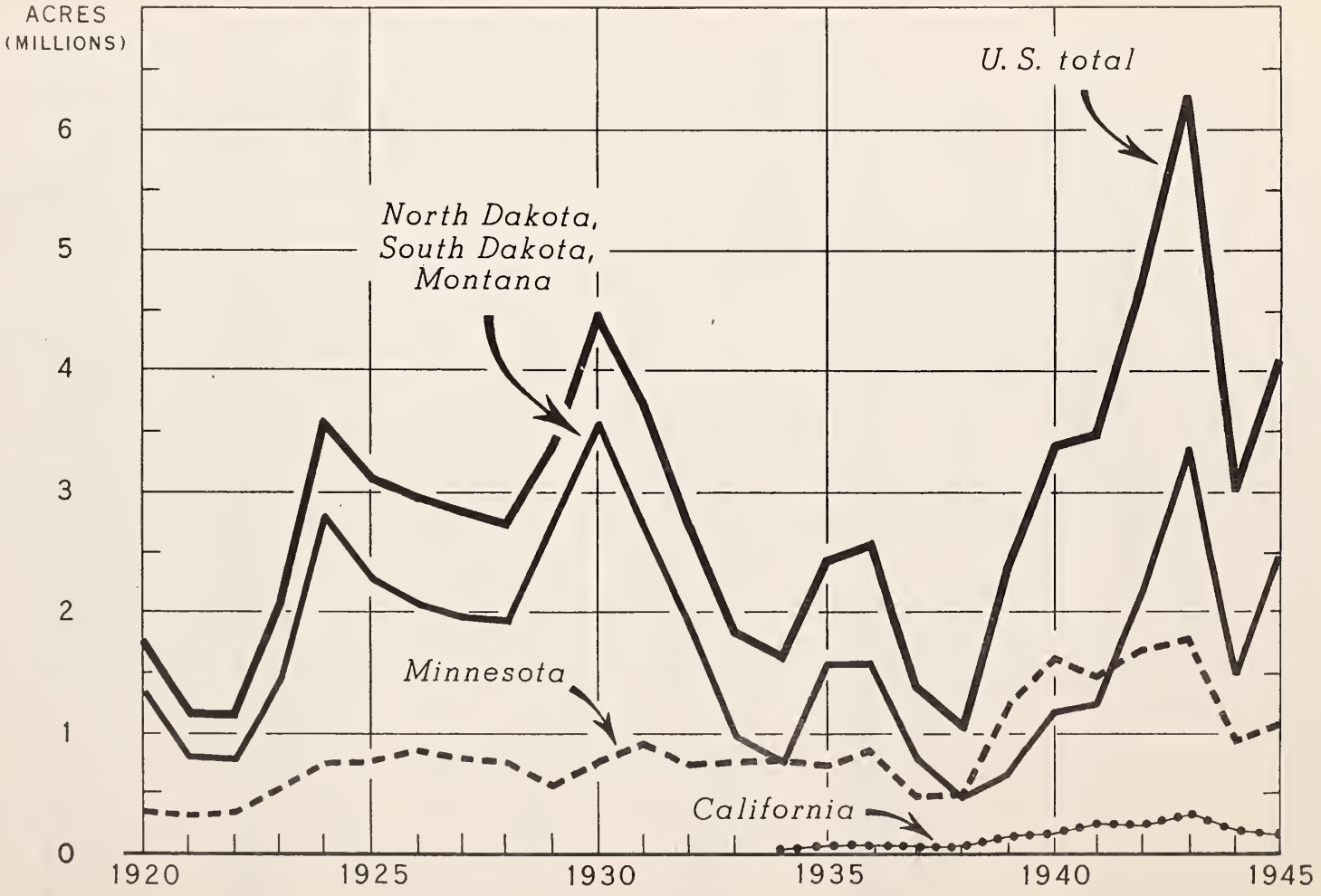


Figure 18.- Both the long-time upward trend and the wartime increases in acreage and production of peanuts were more pronounced in the Old Area of the southeast and in the Oklahoma and Texas Area than in the other areas.

FLAXSEED: ACREAGE PLANTED IN MAJOR PRODUCING AREAS AND IN THE UNITED STATES, 1920-45



U. S. DEPARTMENT OF AGRICULTURE NEG. 45822 BUREAU OF AGRICULTURAL ECONOMICS

Figure 19.- The acreage of flaxseed is subject to extreme fluctuations. The 1943 acreage was more than three times the average of 1935-39, but in 1943 and 1944 the acreage fell off sharply although it remained well above the prewar level.

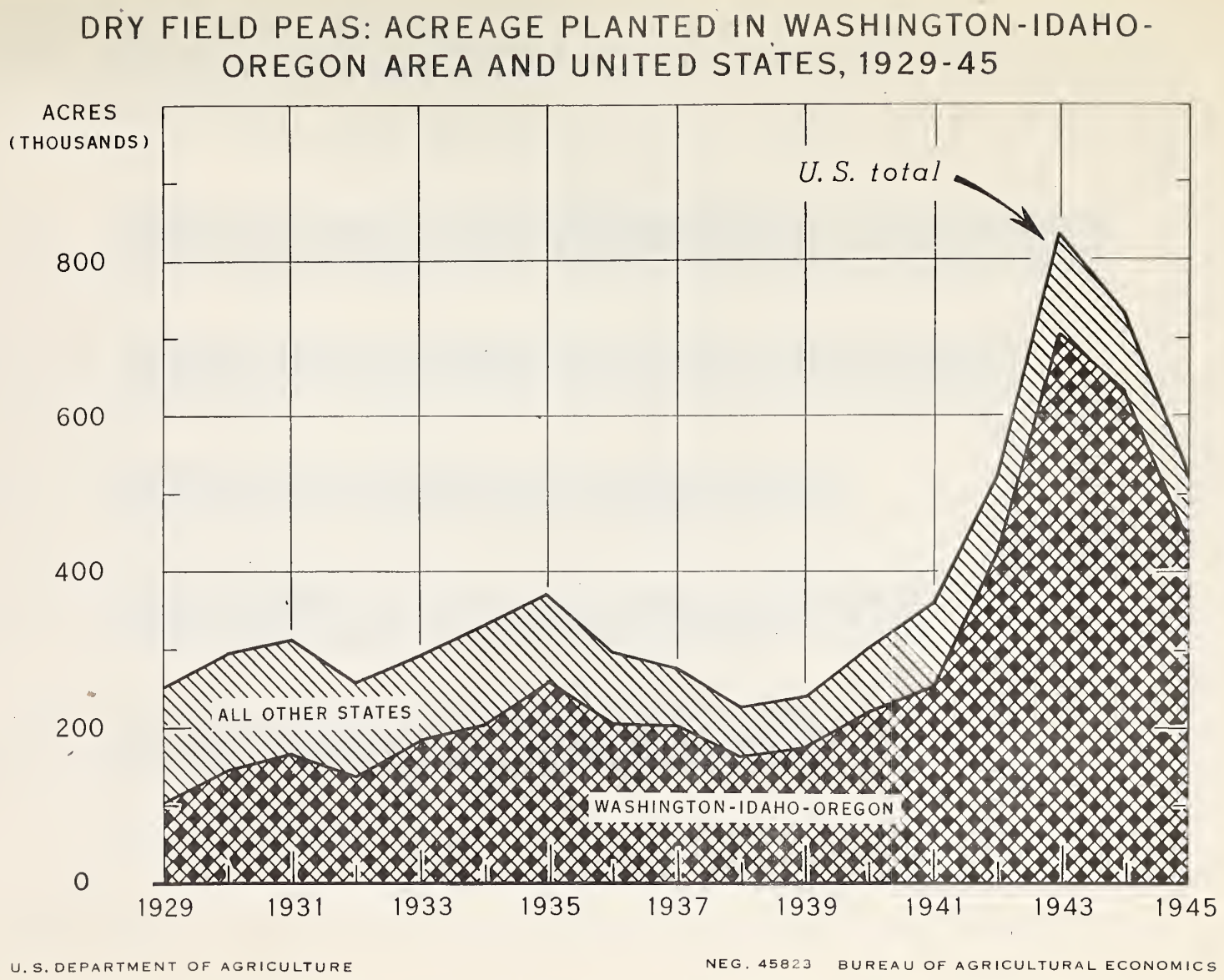


Figure 20.- The acreage of dry field peas increased sharply in the early years of World War II and declined in 1944 and 1945, but remained about double the prewar acreage. The Pacific Northwest States produced the bulk of the United States production.

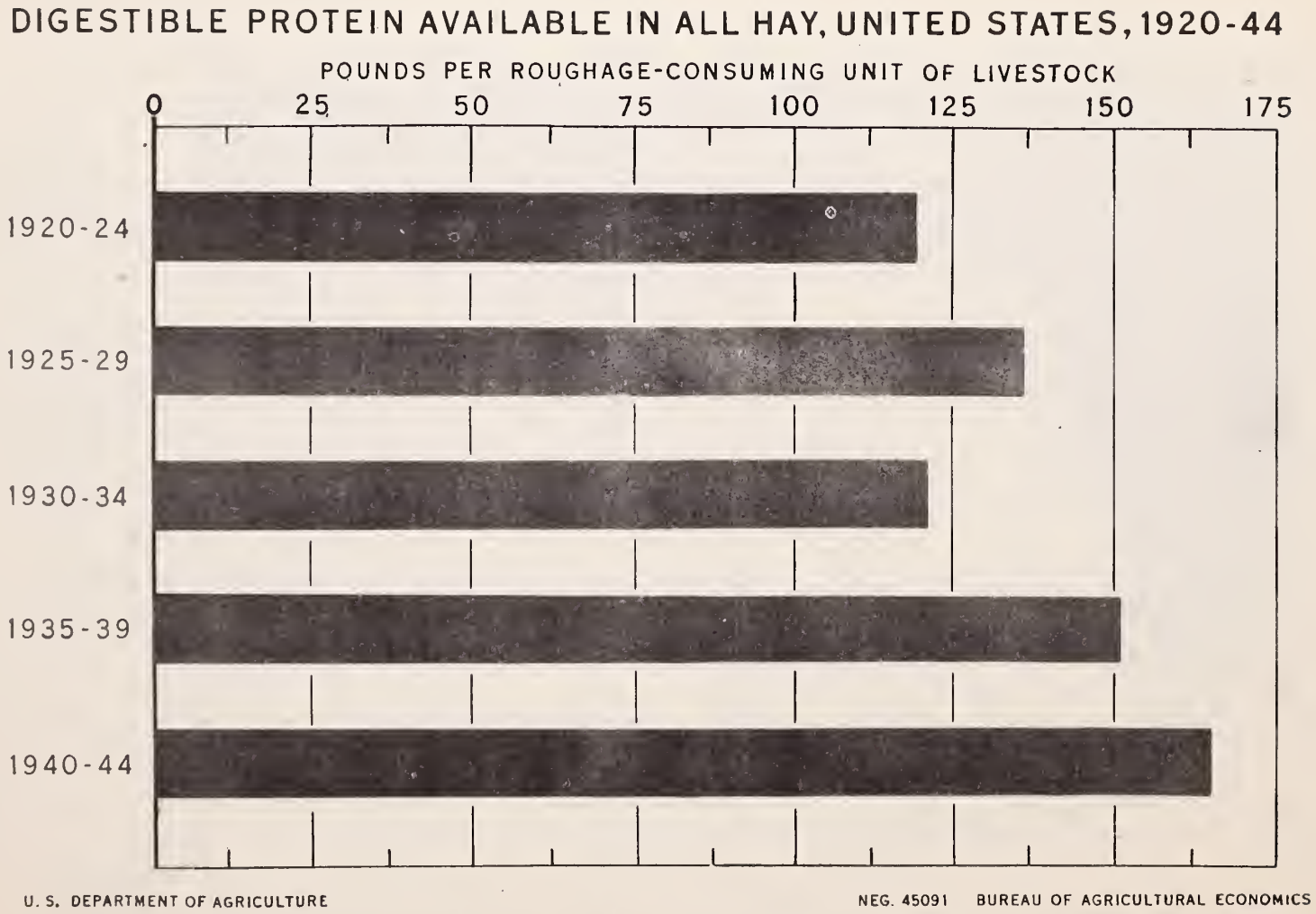


Figure 21.- Significant changes have taken place in both quantity and quality of the country's hay supply. During the last 5 years of the 1920-44 period 39 percent more digestible protein was available per roughage-consuming unit of livestock than for the first 5 years of this period. The pronounced shift from grass to legume hays has been the largest contributing factor.

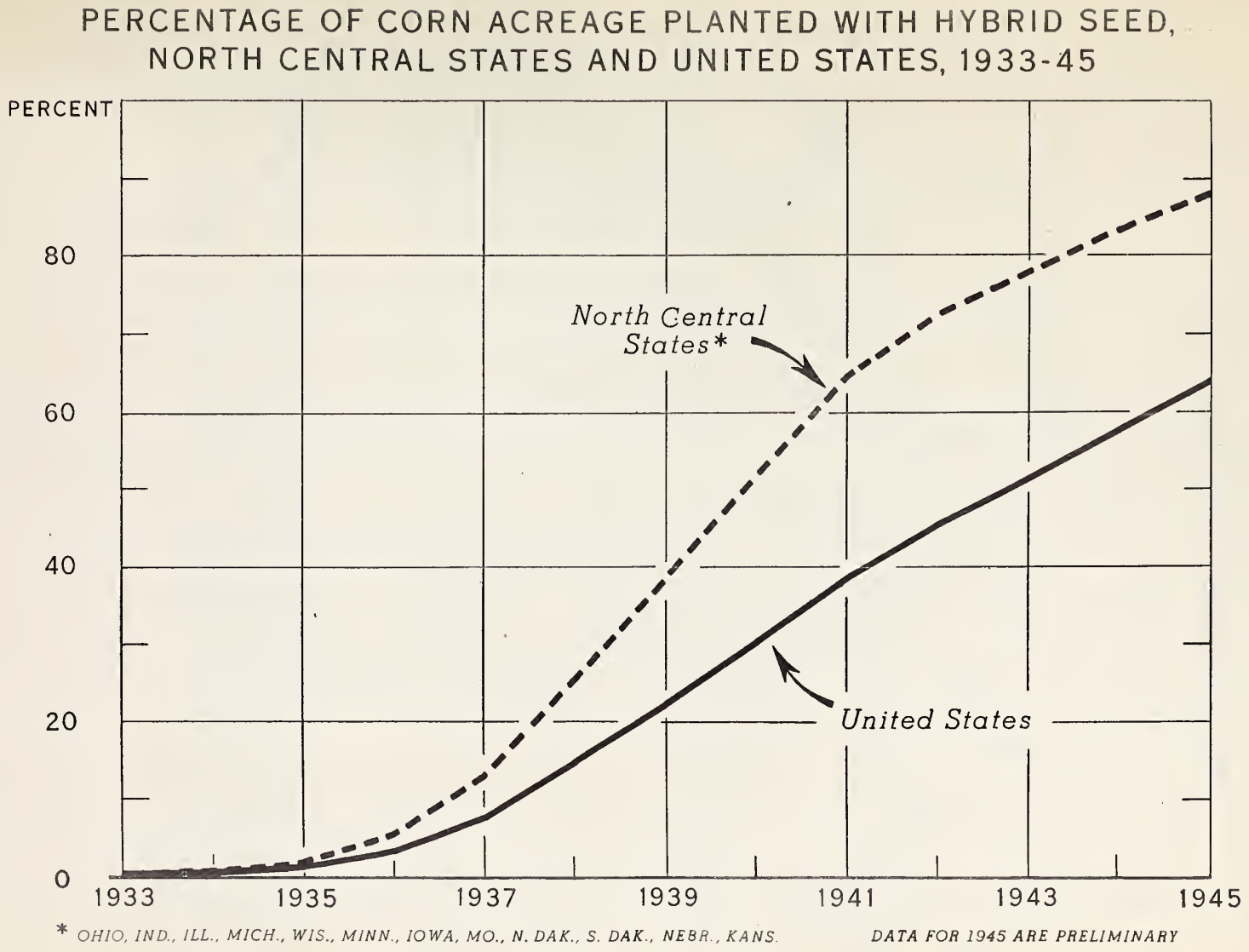


Figure 22.- From the merest beginnings in 1933, hybrid seed had replaced open-pollinated varieties on about 64 percent of the total acreage planted in 1945. The increase has been most rapid in the North Central States, where it was used for planting 88 percent of the acreage in 1945.

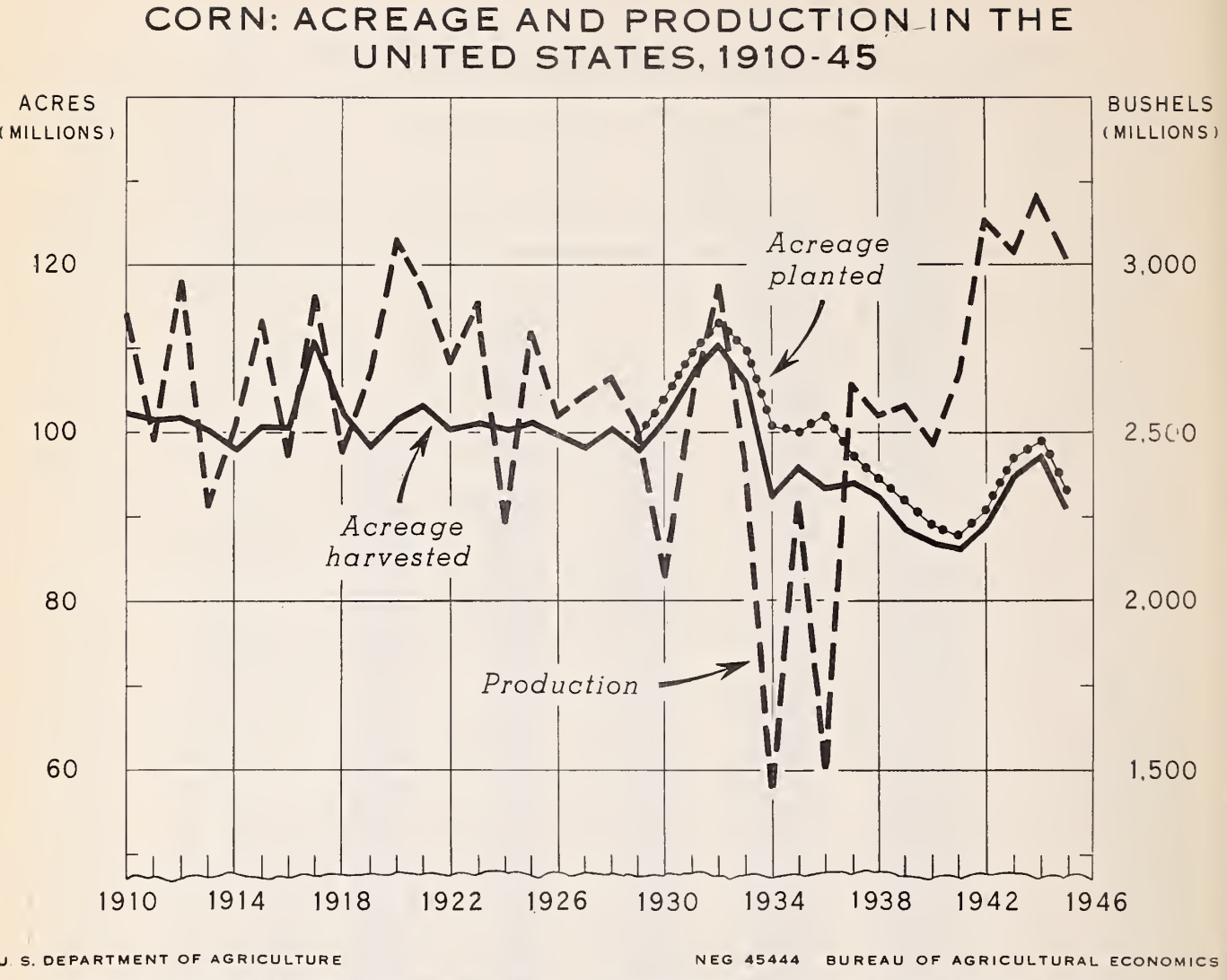
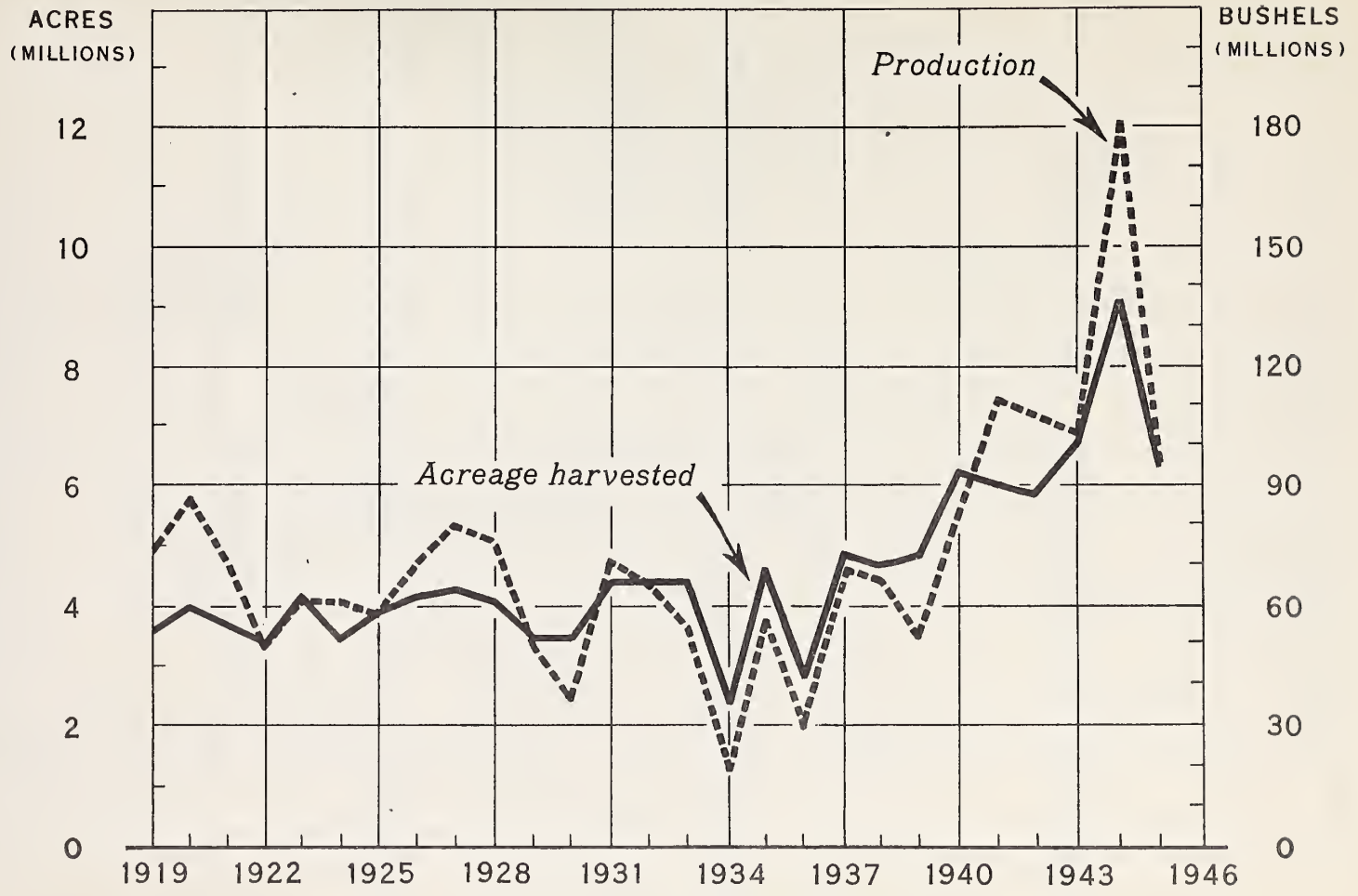


Figure 23.- The acreage of corn harvested in the United States remained approximately stable from 1910 to 1930--at about 100 million acres--except in 1917. Record acreage of corn was established in that year under combined circumstances of World War I and an extraordinary winter-killing of wheat. During the depression--1931, 1932, and 1933--farmers in many areas increased their acreage in an effort to offset low prices. The drought in 1934, and the corn-acreage allotment program steadily brought acreage down to about 86 million acres in 1941. During World War II, acreage has returned to near the 1910-30 average level.

SORGHUMS FOR GRAIN: ACREAGE AND PRODUCTION IN THE UNITED STATES, 1919-45*



*1919-28 ONLY GRAIN SORGHUMS FOR GRAIN

U. S. DEPARTMENT OF AGRICULTURE NEG. 45449 BUREAU OF AGRICULTURAL ECONOMICS

Figure 24.- Between 1919 and 1939 the acreage of sorghums harvested for grain averaged about 4 million acres. Because the crop is grown under very hazardous weather conditions, production during this period ranged from 19.2 million bushels to 88 million bushels. Both acreage and production since 1939 has been far above the prewar level.

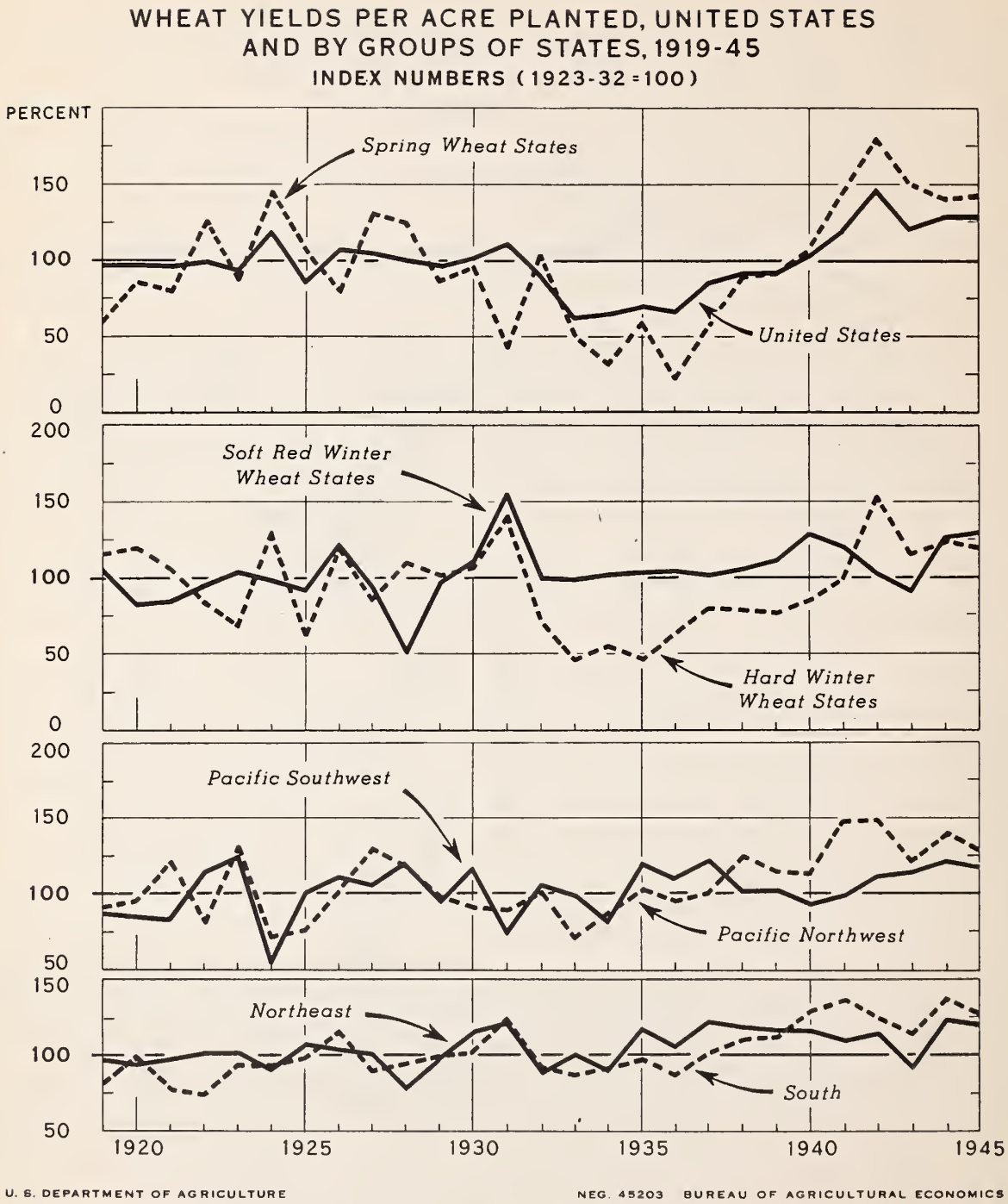


Figure 25.- Yields of wheat have been above the 1923-32 average in most years since 1940, in all regions. Yields in the Pacific Northwest and the Southern States since 1938 have been materially higher than during the 10-year 1923-32 period before the droughts.

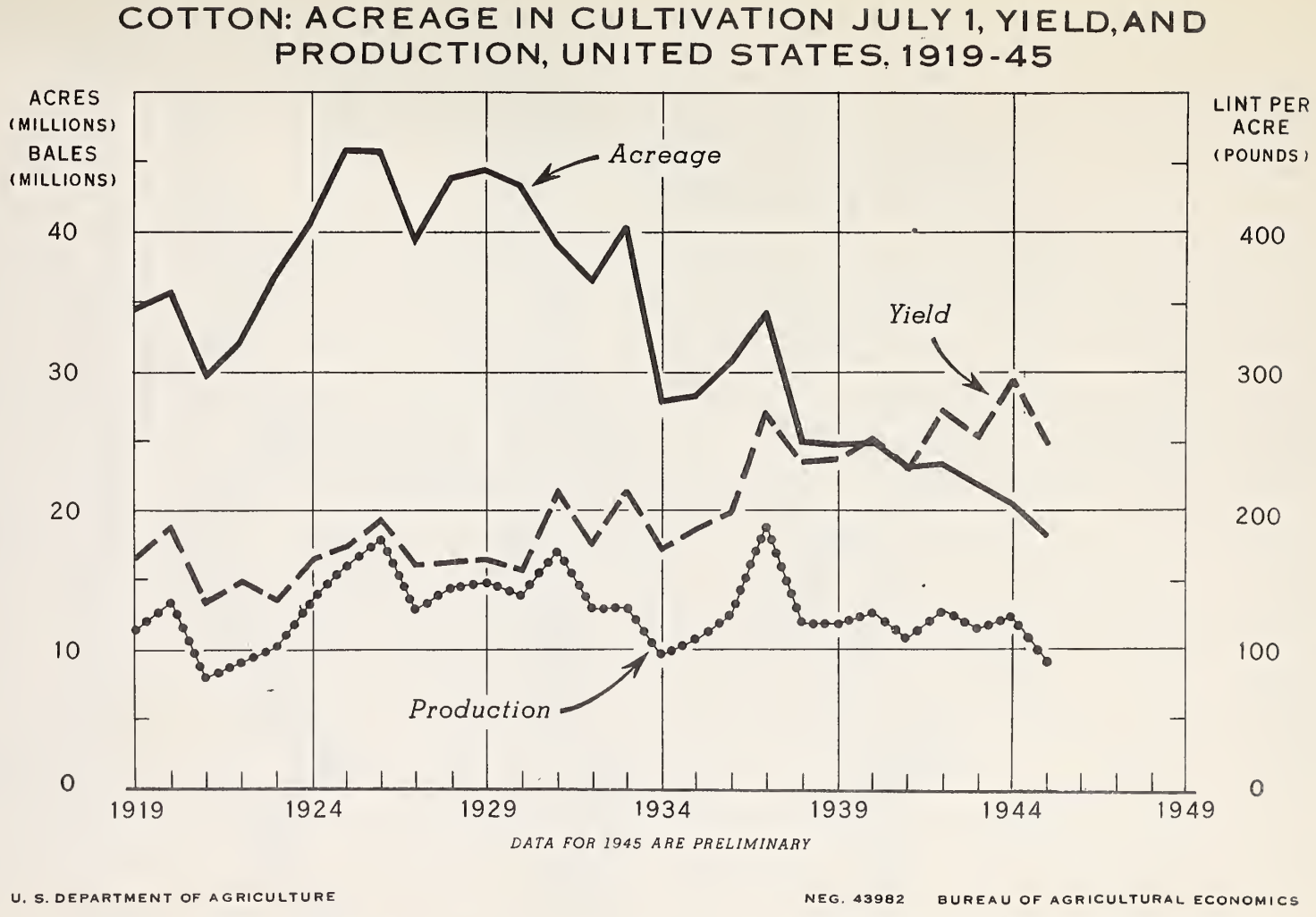


Figure 26.- Cotton acreage was increasing from 1921 to 1926, when nearly 46 million acres were planted. Since 1926 the trend has been downward. Production shows a smaller downward tendency than acreage because the trend of yields has been upward.

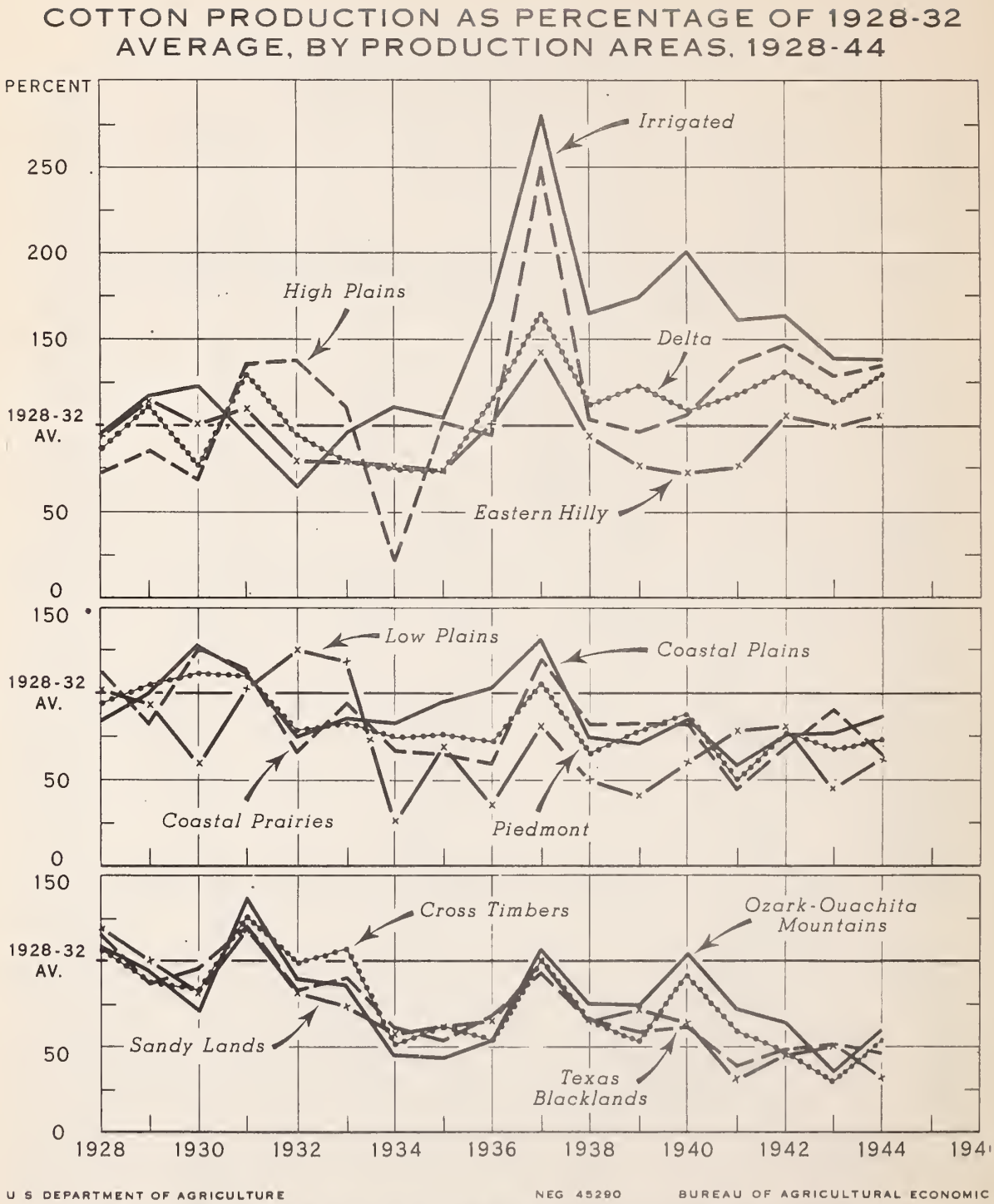


Figure 27.- The wartime cotton acreage has been below the prewar level in all except the irrigated areas. This has resulted in a decrease in production except in the areas where increased yields have more than offset the smaller acreage.

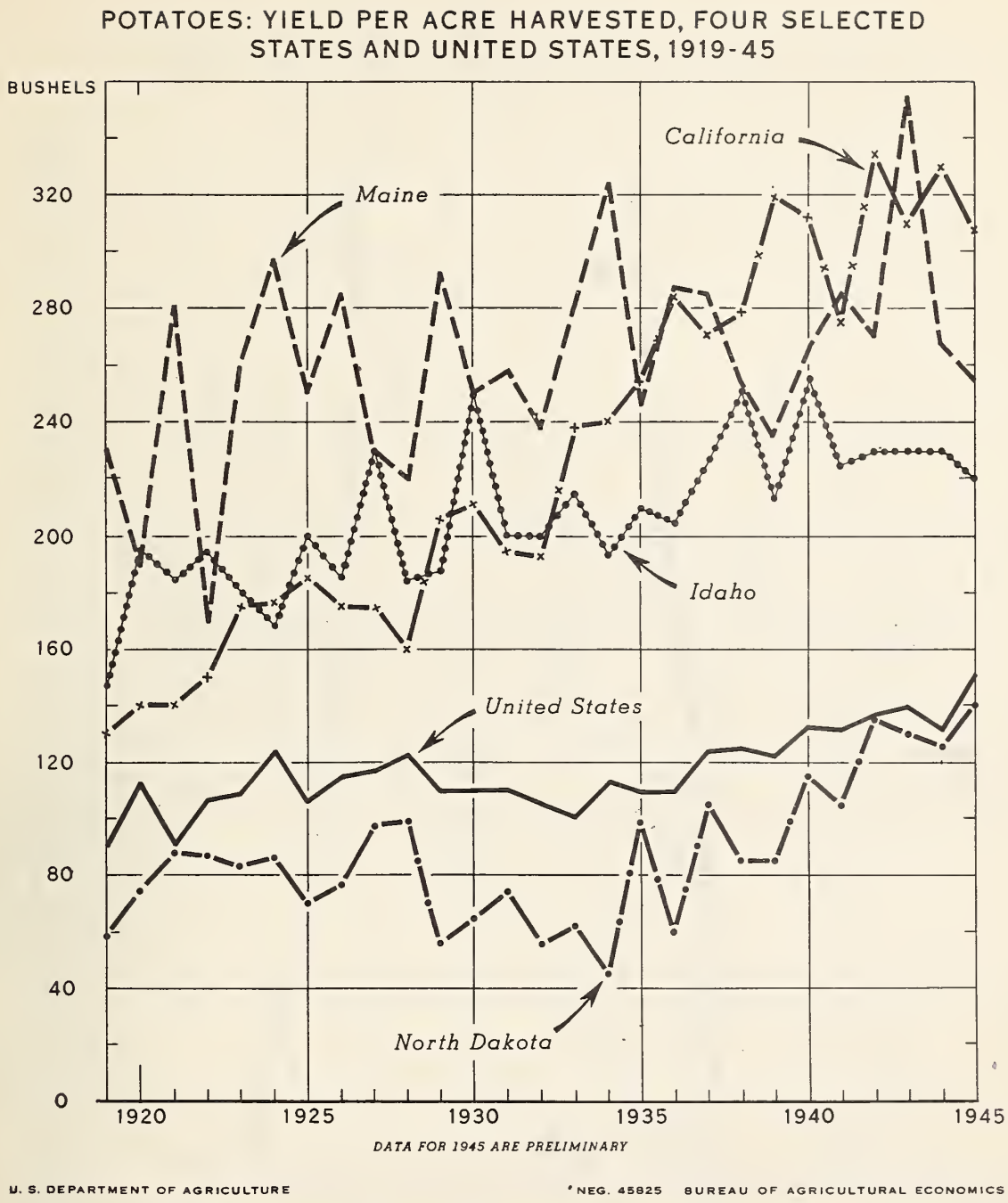
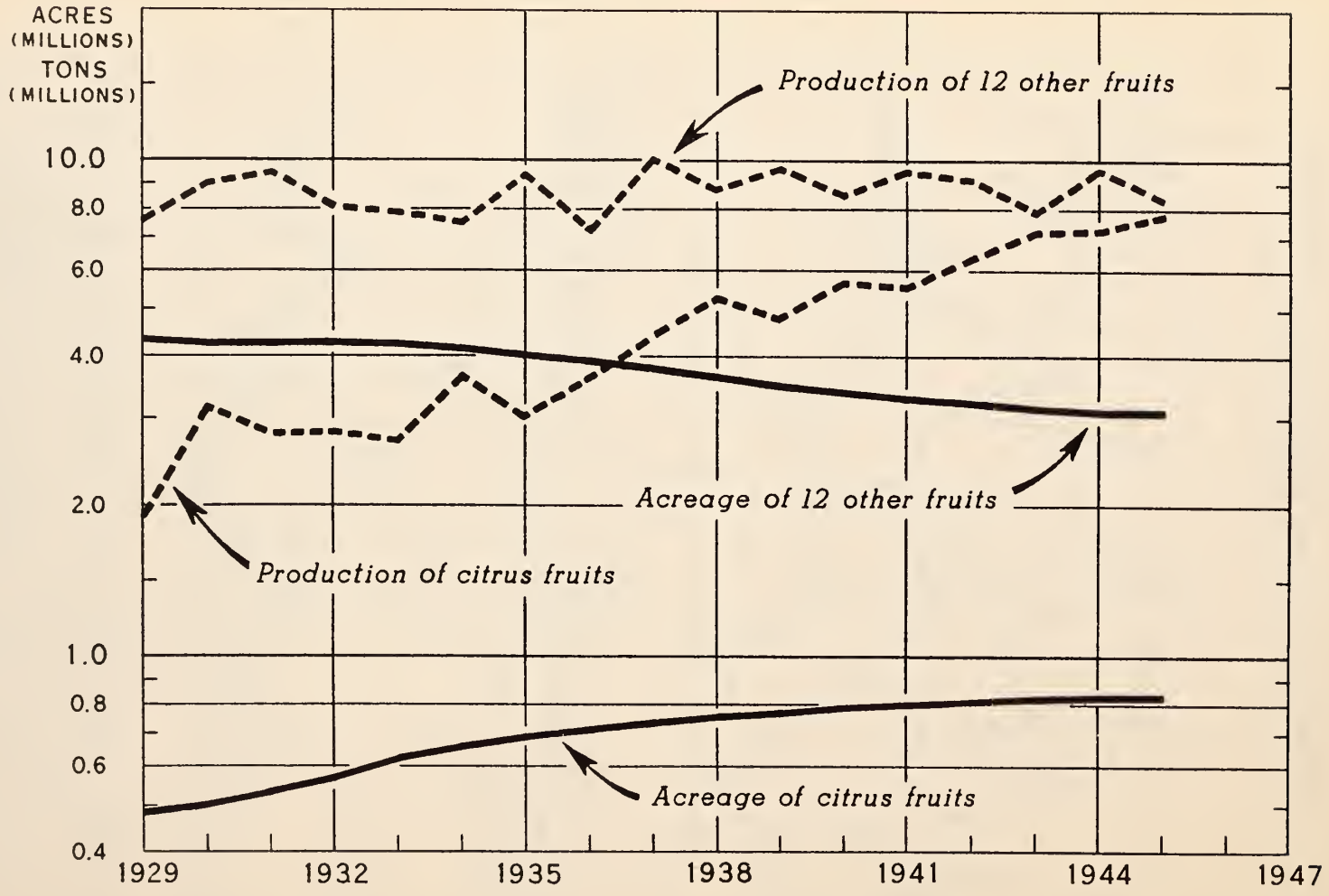


Figure 28.- Maine, Idaho, and California produce about one-third of the potatoes grown in the United States. They are the only States that consistently show yields above 200 bushels per acre. Production there is concentrated on land best suited to potatoes and in relatively large-scale enterprises. North Dakota production has shown a marked shift from farm production for home supply to commercial production in the Red River Valley. Increase in United States average yields reflects the extension of acreage by commercial growers who apply effective production practices.

ACREAGE AND PRODUCTION OF CITRUS FRUITS AND OF 12 OTHER MAJOR FRUITS, UNITED STATES, 1929-45

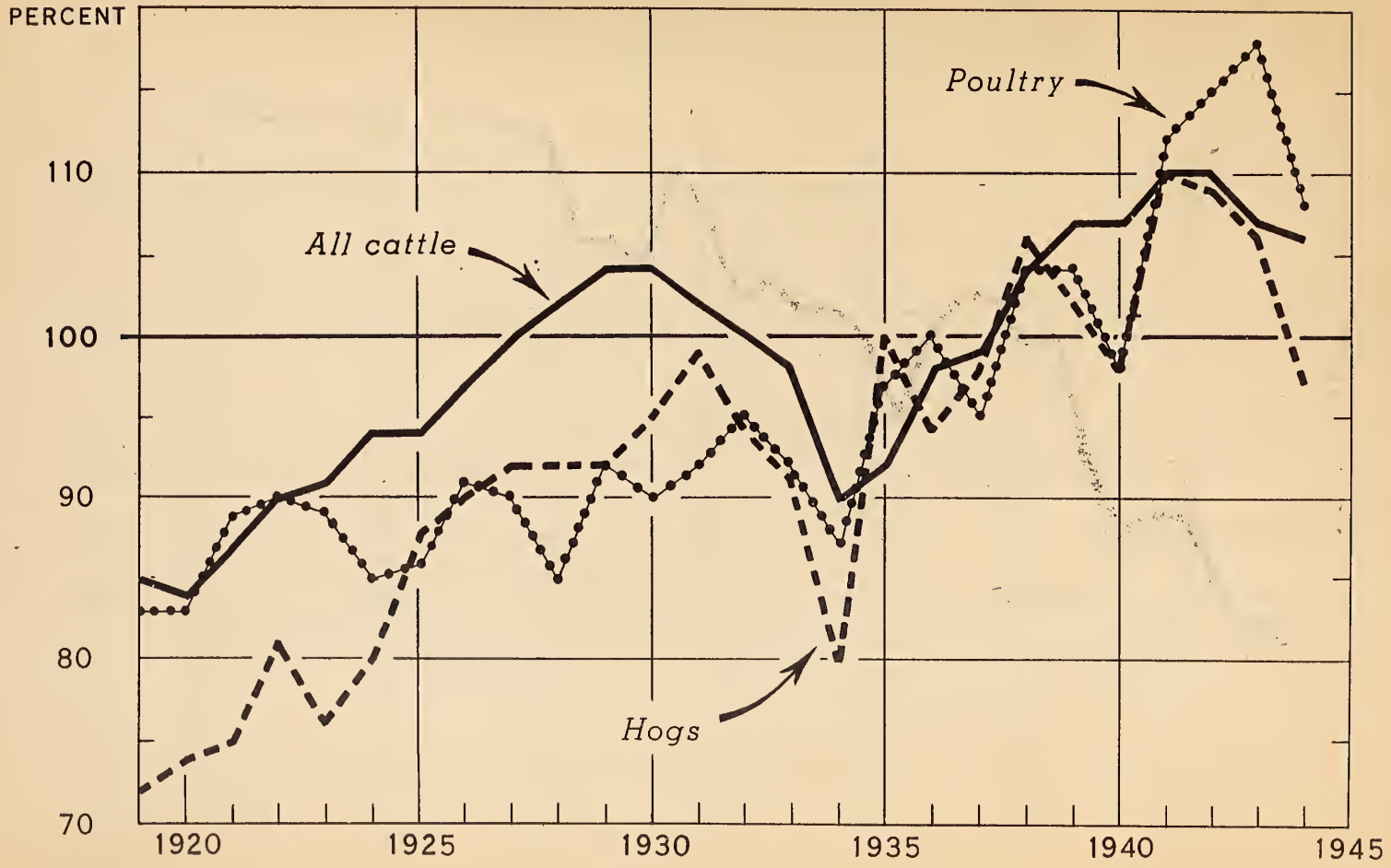


U. S. DEPARTMENT OF AGRICULTURE NEG. 45826 BUREAU OF AGRICULTURAL ECONOMICS

Figure 29.- Acreage of citrus fruit has steadily increased since 1930, while the acreage of deciduous fruits has declined. The increase in production of all fruits is almost entirely due to the rapid increase in production of citrus fruits, which account for almost one-half of total production on a tonnage basis.

PRODUCTION PER UNIT OF BREEDING LIVESTOCK: ALL CATTLE, HOGS, AND POULTRY, 1919-44

INDEX NUMBERS (1935-39=100)



U. S. DEPARTMENT OF AGRICULTURE NEG. 45827 BUREAU OF AGRICULTURAL ECONOMICS

Figure 30.- Hog production per animal unit of breeding livestock has shown the steepest upward trend among the different classes of livestock over the last 25 years. However, production per unit rose rapidly in each class of livestock during the war.

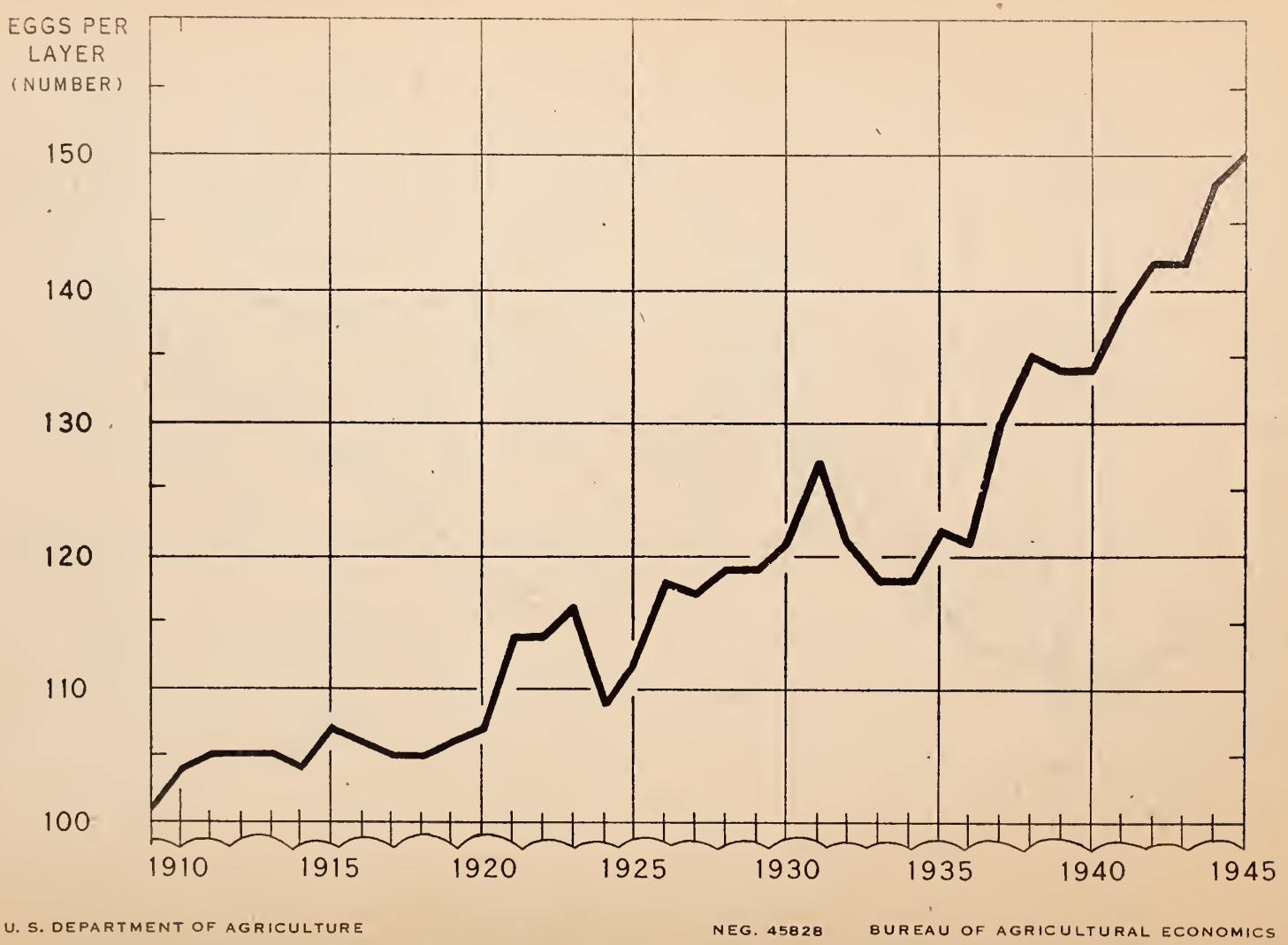


Figure 31.- Egg production per layer shows an upward climb of 50 percent for the period from 1909 to 1945, with no indication of leveling off except during the drought and depression of the early 1930's.

MILK: PRODUCTION PER COW MILKED ON FARMS, UNITED STATES, 1909-45

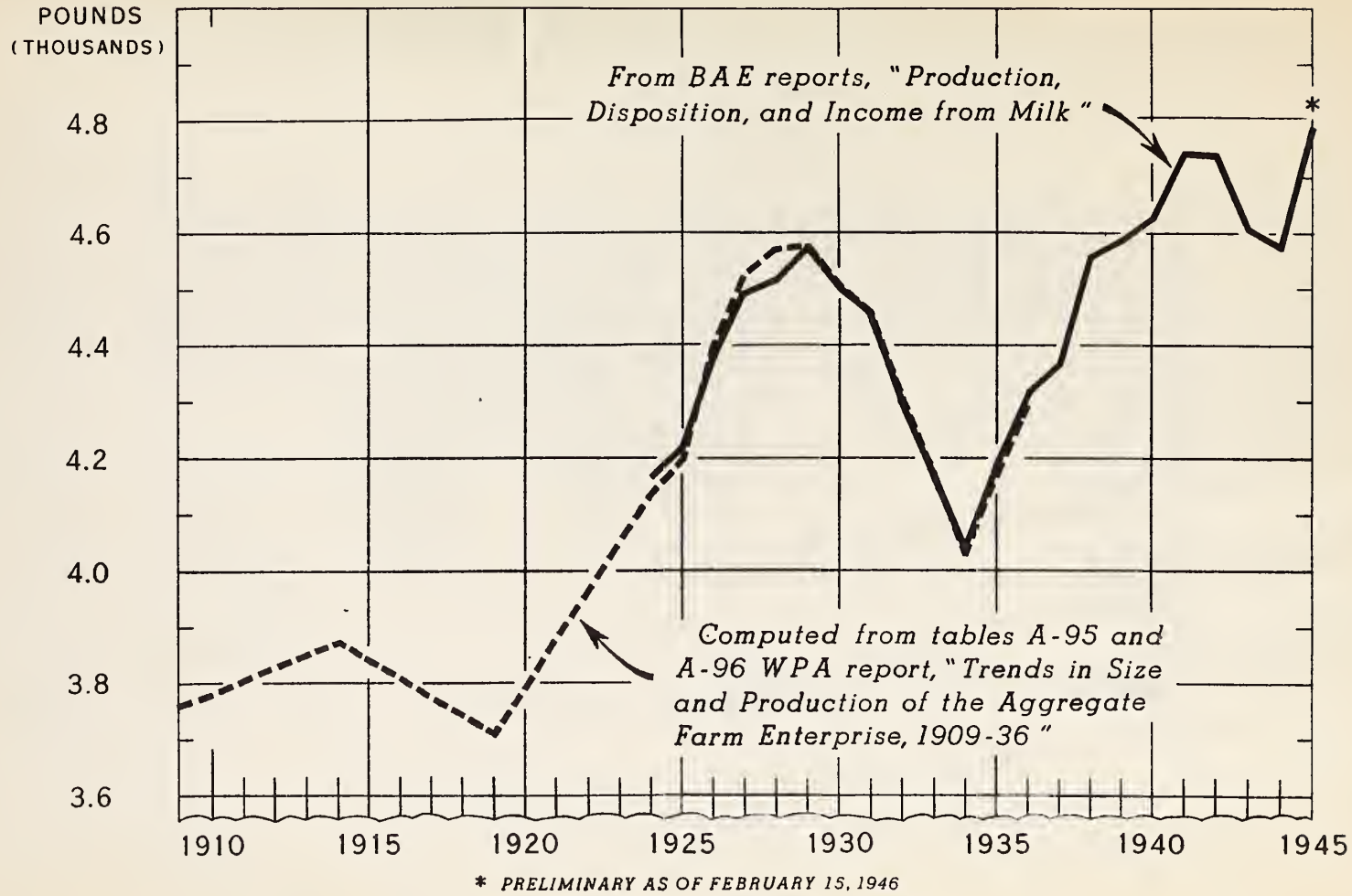


Figure 32.- A definite upward trend in milk production per cow for the period since 1909 was interrupted briefly during World War I, and then for a longer time in the drought and depression of the 1930's. An all-time peak was reached in 1945.

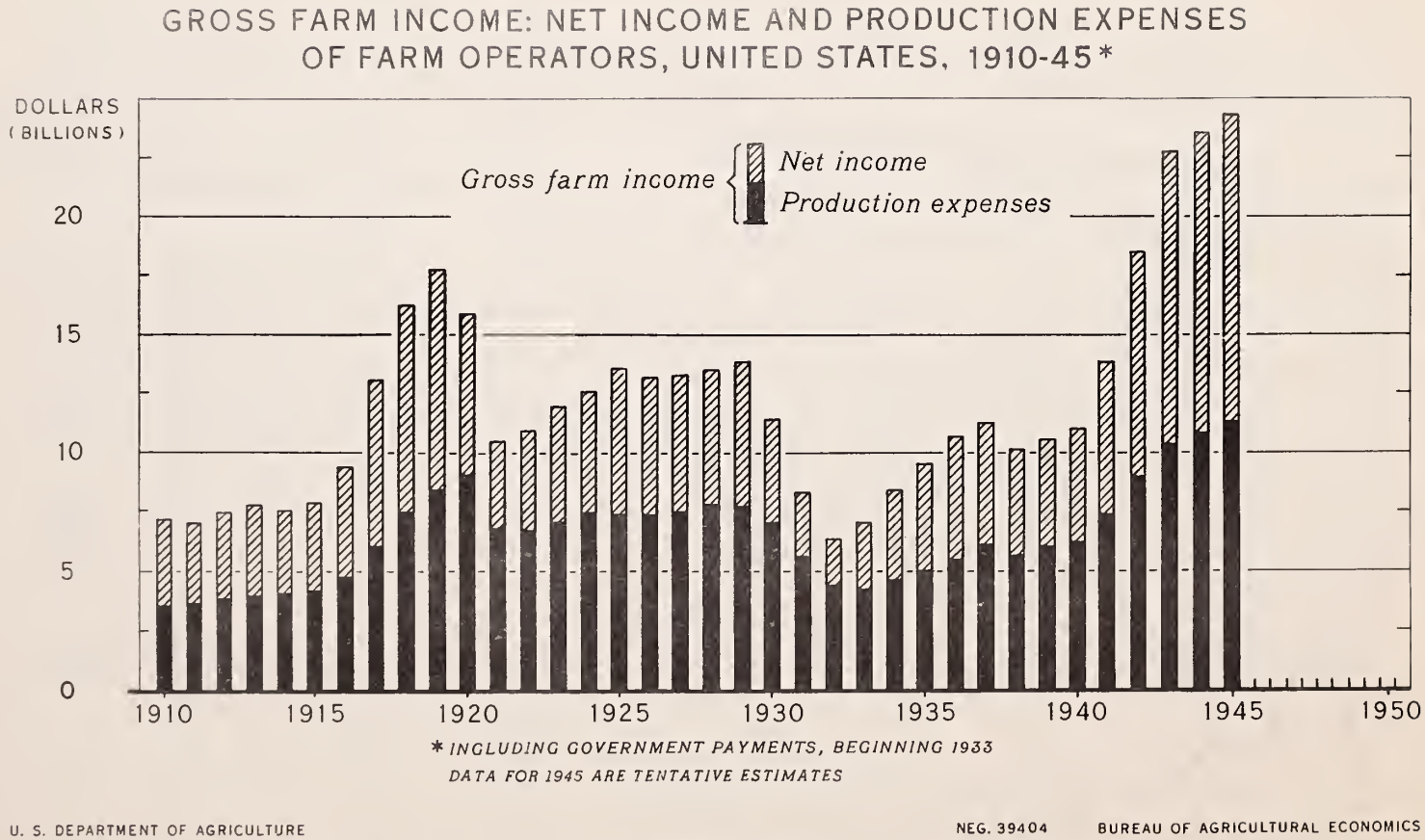


Figure 33.- Production expenses of farm operators have increased since 1940 but gross farm income has increased more rapidly than expenses, resulting in a higher net income for farm operators.

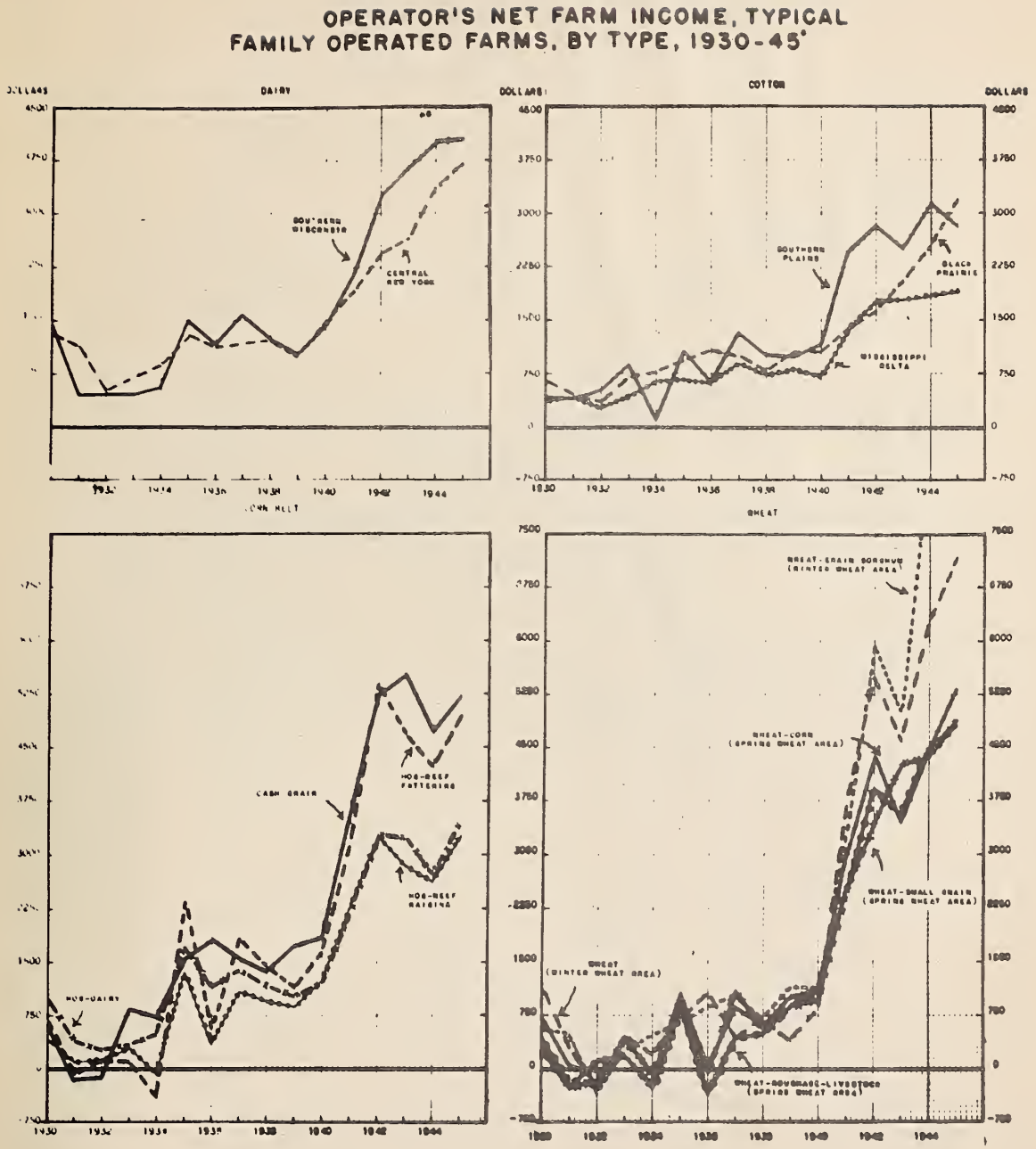
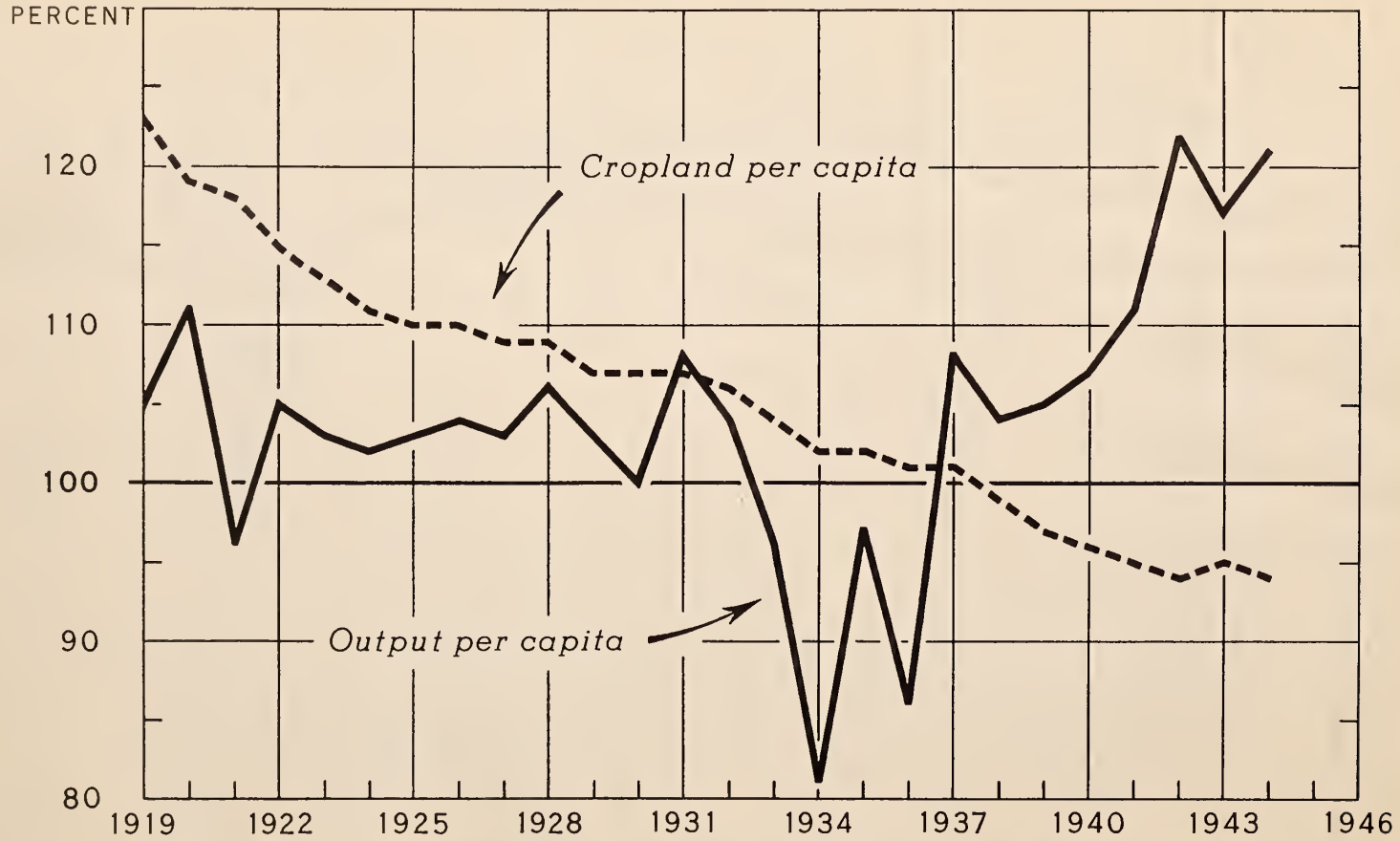


Figure 34.- Annual earnings of farm families operating all types of farms seem to follow the same general pattern. The extremely low net incomes of the drought and depression years 1931-36 were followed by some recovery in the late 1930's. The sharp rise in the war years resulted from higher prices combined with increased production per farm.

FARM OUTPUT PER CAPITA, AND TOTAL FARMLAND PER CAPITA, UNITED STATES, 1919-44*

INDEX NUMBERS (1935-39=100)



*OUTPUT PER CAPITA OF TOTAL POPULATION. TOTAL CROPLAND IS THE SUM OF THE ACREAGE OF LAND FROM WHICH ONE OR MORE CROPS WERE HARVESTED PLUS FALLOW AND CROP FAILURE ACREAGE.

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Figure 35.- Cropland acreage per capita decreased steadily for the last quarter-century, while the per capita output of farm products was maintained in most of the interwar years and increased sharply during the war. The release of cropland from production of horse and mule feed largely made possible the maintenance of output per capita in the interwar years. Increased crop production per acre was mostly responsible for the wartime expansion in output per capita.

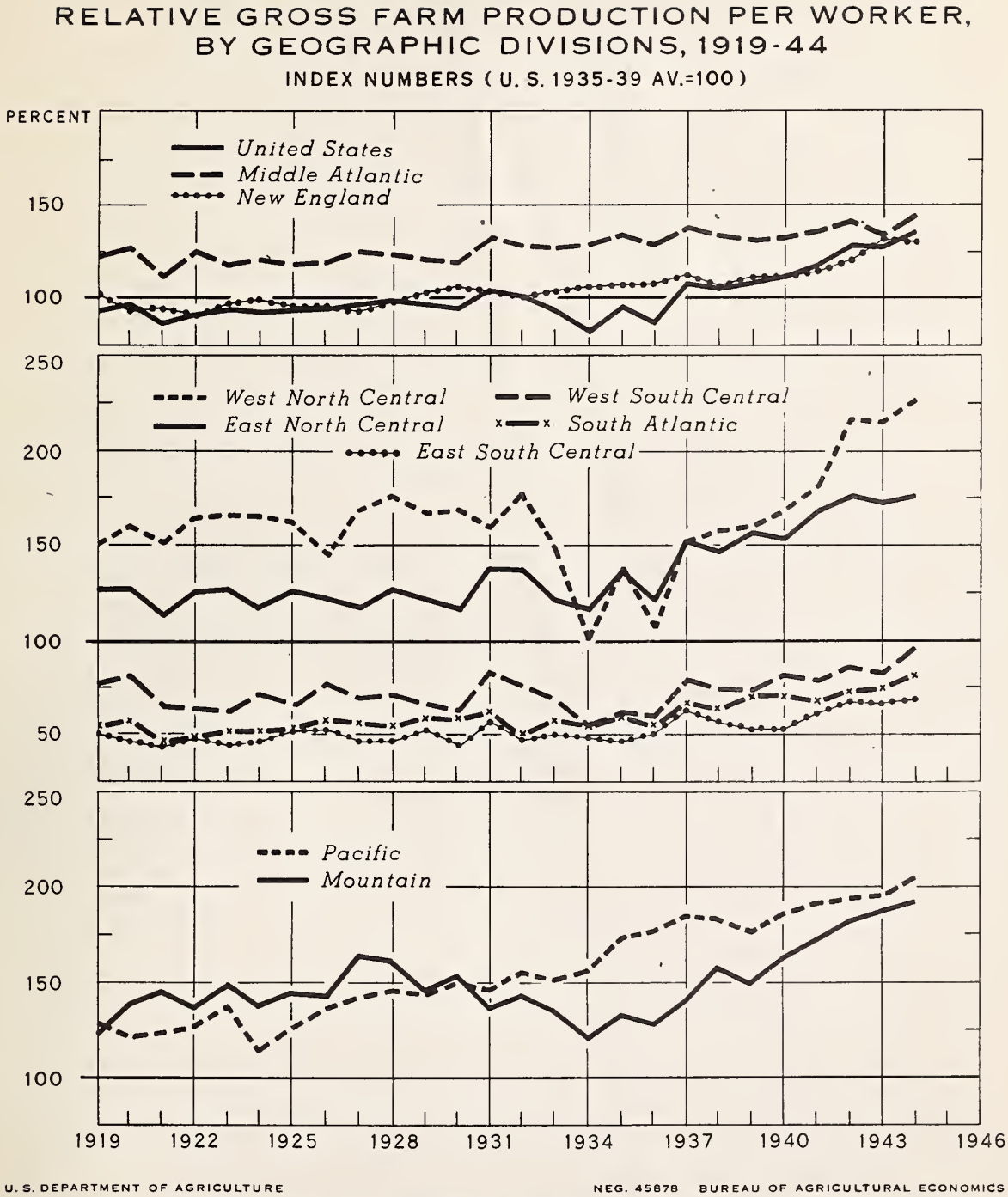

Figure 36.- Farm production per worker has been lowest in the Southern divisions over the last 25 years. The most consistent upward trend in production per worker has taken place in the Pacific division, although relatively greater wartime increases occurred in the North Central and Mountain divisions.